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NEOEN

OFFSET MANAGEMENT STRATEGY

Mount Hopeful Wind Farm Project

FINAL

March 2024

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FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Neoen Australia Pty Ltd

Report No. 22753/R04
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Environmental & Social Consultants

This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

Acknowledgement of Country

Umwelt would like to acknowledge the traditional custodians of the country on which we work and pay respect to their cultural heritage, beliefs, and continuing relationship with the land. We pay our respect to the Elders – past, present, and future.

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1.0 Introduction

1.1 Background

Neoen Australia Pty. Ltd (Neoen) is proposing to develop the Mount Hopeful Wind Farm Project (the Project). The Project is located 45 kilometres (km) south of Rockhampton and 65 km west of Gladstone, Queensland, between Dee Range and Mount Alma Range. The Project involves the construction and operation of 63 wind turbines and associated infrastructure.

The Project proposes to impact native vegetation and may have a significant impact on six Matters of National Environmental Significance (MNES) listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), identified in **Section 3.0**. The Preliminary Documentation and Offset Management Strategy has been amended in late 2023 to include an updated micro siting area around the switching station with an increase of 9.5 ha to the disturbance corridor and the addition of 0.2 ha of access road to extend the existing proposed road to South Ulam Road resulting in an increase to the Study area and Disturbance Footprint as presented in **Section 1.1.1**. As well as the boundary changes, a pair of koala adult and joey (*Phascolarctos cinereus*) were detected (property F3) in October 2023, and the extent of *Cycas megacarpa* has been amended following pre-clearance surveys conducted during 2023 within the Disturbance Footprint, to inform final design planning and translocation requirements.

The additional areas, koala detection and habitat mapping refinement for *Cycas megacarpa* have been incorporated into the offset assessment guide calculations and throughout the Offset Management Strategy including **Section 3.0** and **Section 7.3**.

In accordance with the *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy* (Department of Sustainability, Environment, Water, Populations and Communities (DSEWPaC) 2012) (the Offsets Policy), offsets must be secured to counterbalance the significant impact to MNES and ensure an overall environmental improvement. Currently, five properties have been assessed to meet offset obligations these being Properties R1, R2 and Properties F1, F2 and F3.

1.1.1 Project Boundaries

For the purposes of this report, three distinct boundaries relevant to the Project are referred to:

- **Study Area**: The Study Area refers to the boundaries of the 17 freehold land parcels which encompass the infrastructure that has been designed for the proposed wind farm, as well as the boundary of the access road corridor (inclusive of the local road reserve for Glengowan Road, Playfields Rd and McDonalds Rd and small area of one additional adjacent land parcel) and a connection to the switching station in the road reserve at South Ulam Road. The area covers approximately 16,976 hectares (ha) and extends approximately 25 km north-south at the longest point and 42 km east-west at the widest point (this includes approximately 30 km of access road). The Study Area represents the limit of the vegetation and habitat mapped for the Project. It should be noted however, that this boundary does not represent the spatial bounds in which all Project field surveys have been conducted (this area being larger and including areas outside of the Study Area).

- **Development Corridor:** The Development Corridor is a 'buffered' version of the indicative Project layout, covering approximately 1,564.6 ha. This area represents the maximum spatial extent where disturbance may occur within the Study Area and includes areas required for temporary and permanent Project infrastructure, equipment and materials laydown, installation and access. This includes an access road corridor that is situated between the Burnett Highway at Dixalea and Glengowan Road at the southwestern extent of the Project.

- **Disturbance Footprint:** The Disturbance Footprint covers approximately 883.6 ha and represents the maximum extent of clearing works and the indicative locations of Project infrastructure. It is a 'worst-case' scenario in terms of the extent of clearing works. As infrastructure will be micro-sited within the Development Corridor, the final clearing areas are anticipated to be lower than detailed in this assessment.

More detail on these boundaries is provided in Section 1.0 of Attachment B1 (Assessment of Matters of National Environmental Significance).

1.2 Aims and Objectives

The aim of this Offset Management Strategy is to present the Project's approach to offset delivery and provide a framework for further offset actions, delivered post Project approval, such as the development of an Offset Area Management Plan (OAMP). The Offset Management Strategy will:

- Detail the Commonwealth regulatory framework with regard to offsets and outline the guiding principles in which this Offset Management Strategy has been prepared.

- Document MNES values known to the project, including potential impacts and significant impacts.

- Present proposed avoidance and mitigation measures taken by the Project.

- Identify the approach to offset delivery, including target offset properties, with supporting evidence which demonstrates, for relevant MNES, the potential suitability of habitat and outcomes of habitat quality scoring undertaken.

- Provide the calculations for offset requirements for MNES using the Commonwealth Offset Assessment Guide (OAG) and present information on the methodology, justification and supporting evidence for input into the OAG.

- Describe the proposed strategy with regard to legal mechanisms for securing offsets.

- Complete a risk assessment focussing on threats to protected matters as well as the delivery of the offset.

- Demonstrate that offsets are proportionate, suitable and feasible for the identified MNES and the Project region.

It should be noted that potential offsets for bird and bat species impacted by wind turbine collisions, may be provided on a contingency basis and do not form part of this Offset Management Strategy. This issue will be addressed in the Bird and Bat Adaptive Management Plan (BBAMP). As part of this management plan, if monitoring determines that mortality rates exceed proposed impact thresholds, offsets may be necessary and will be sought and secured, in consultation with the Department of Climate Change, Energy, the Environment and Water (DCCEEW).

2.0 Regulatory Framework

2.1 Environment Protection and Biodiversity Conservation Act 1999

The *EPBC Act Environmental Offsets Policy* (DSEWPaC 2012) outlines the Commonwealth's approach to the use of environmental offsets and the requirements for an offset package to be deemed suitable. The suitability of a proposed offset is considered as part of the decision to approve or not approve a proposed action under the EPBC Act. The offset package can comprise a combination of direct offsets (land-based) and other compensatory measures, however direct offsets in most cases must comprise at least 90% of the overall offsets package.

Direct offsets must provide a measurable net conservation gain for an impacted protected matter. This conservation gain is the benefit that an offset delivers, which maintains or increases its viability, or reduces any threats of damage, destruction or extinction (averted loss). A conservation gain may be achieved by:

- Improving existing habitat for the protected matter.
- Creating new habitat for the protected matter.
- Reducing threats to the protected matter.
- Increasing the values of a heritage place. And/or
- Averting the loss of a protected matter or its habitat that is under threat.

Considering future risks to a specific site in order to quantify averted loss is undertaken over either a 20-year timeframe or for the duration of the offset, whichever is the shorter period.

When assessing the potential suitability of an offset site, a number of key factors should be considered. For impacts on habitat for threatened species, migratory species and threatened ecological communities, any direct offset must meet, as a minimum, the quality of the habitat at the impact site. Offsets should also compensate for an impact for the full duration of the impact. Other considerations include, but are not limited to:

- Current land tenure and the proposed method of securing and managing the offset.
- The time it will take to achieve the proposed conservation gain.
- The level of certainty that the proposed offset will be successful.
- The suitability of the offset location; in most cases this will be as close to the impact site as possible.

2.1.1 Policy Principles

The *EPBC Act Environmental Offsets Policy* (DSEWPaC 2012) identifies ten policy principles explaining what is considered a suitable offset and guidance on how the Minister makes decisions when assessing offset proposals. The policy principles are identified in **Table 2.1**, along with a justification of how this Offset Management Strategy has taken into consideration each principle.

Table 2.1 Demonstration of Compliance with EPBC Act Environmental Offsets Policy Principles

Policy Principle	Justification/Relevant Section	Fulfillment of Policy Principles
Suitable offsets must deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environmental law and affected by the proposed action.	The proposed approach to satisfying offset requirements for the Project is to secure suitable areas of land within the immediate region of the project, comprising habitat that is commensurate with that recorded at the impact site (**Section 5.0**). There is scope for further improvement via both habitat enhancement (managed growth) and threat abatement strategies (**Section 7.0**).	This proposed offset area contains large areas of habitat suitable for habitat enhancement and threat abatement. This has been verified by field survey, with habitat areas validated as commensurate with the impact site. Management actions to achieve a conservation gain have developed, in response to identified threats and habitat quality scoring specific to each impacted MNES. Based on the above, the Offset Management Strategy is considered to fulfil the policy principle.
Suitable offsets must be built around direct offsets but may include other compensatory measures.	The offset package can comprise a combination of direct offsets (land-based – at least 90% of the total) and other compensatory measures i.e., 10% research; this Offset Management Strategy presents largely a land based approach for minimum of 90% offset acquittal, with 100% land-based acquittal being achievable (**Section 7.1**). It is noted that other compensatory measures have been investigated and will continue to be assessed for suitability, and may comprise up to 90% of the final offset package (**Section 8.0**).	This Offset Management Strategy in full alignment with the policy principle, and presents an approach built around proponent driven, land based offsets. The Project has identified other compensatory measures, which could be implement as part of the final OAMP however are subject to further investigation and assessment of suitability.
Suitable offsets must be in proportion to the level of statutory protection that applies to the protected matter.	Anticipated offset requirements have been calculated using the *Offsets assessment guide* (OAG) (**Section 7.0** and **Appendix B**), which incorporates the International Union for Conservation of Nature (IUCN) data on the probability of annual extinction for different categories of threatened species. This is calculated based on the current EPBC Act status of each species. Offset requirements are greater for those with a higher conservation status.	This strategy incorporates outcomes of the EPBC Act Offset Assessment Guide. As a result, statutory protection including annual extinction probability has been considered. Based on the justified OAG inputs proposed in this Offset Management Strategy, the offset area in conjunction with proposed habitat quality improvements, were deemed as suitable, meeting 100% of the offset requirement. Based on the above, the Offset Management Strategy is considered to fulfil the policy principle.

Policy Principle	Justification/Relevant Section	Fulfillment of Policy Principles
Suitable offsets must be of a size and scale proportionate to the residual impacts on the protected matter.	Offset requirements have been built around the maximum significant residual impacts likely to occur from the Project (**Section 3.0**), which include fragmentation impacts on enclosed greater glider (southern and central) habitat. Anticipated offset requirements have been calculated using the OAG (**Section 7.3** and **Appendix B**), which considers the conservation status of the protected matter, area of impact to habitat, risk of loss with and without the offset, time it will take to yield a conservation gain, risk of gain not being realised. This offset strategy also considers the requirement for supplementary offsets, should monitoring associated with greater glider (southern and central) fragmentation management measures, indicate controls are ineffective (**Section 8.1.1**).	The proposed offset presents habitat commensurate in type (like for like) with the impact area. The total offset area required has been determined using the maximum SRI and the EPBC Act OAG, in conjunction with species and site specific data, validated through field survey. This includes habitat quality and risk of loss, specific to each MNES. The size and scale of the offset is informed by annual extinction probability, based on each MNES level of statutory protection under the EPBC Act. This offset strategy considers requirements for supplementary offsets. Based on the above, the Offset Management Strategy is considered to fulfil the policy principle.
Suitable offsets must effectively account for and manage the risks of the offset not succeeding.	Risks associated with the effectiveness of suitable offsets are examined in **Appendix C** and will be re-examined with the preparation of an OAMP. This Offset Management Strategy presents a detailed account of ecological field work and desktop assessment specific to each MNES across several proposed offset properties (**Section 6.0**). Based on the habitat quality scoring outcomes, tailored management actions specific to each MNES were created to deliver a conservation gain (**Section 7.3**). The management actions required to secure and then manage the offset areas are: • well established measures • build on and improve largely existing habitat or emerging habitat types • are not reliant on novel or uncertain restoration techniques • avoid approaches that would carry higher risk of delivery. Progressive monitoring of the offset area will be established in the OAMP, with corrective actions or interventions identified and implemented throughout the life of the offset (**Section 9.0**). This approach further mitigates the risk of the offset not succeeding.	The incorporation of measurable, pre-determined and time specific management actions or goals for the offset areas will manage the risk of the offset not succeeding. Progressive monitoring of the offset area will be established in the OAMP, with corrective actions or interventions identified and implemented throughout the life of the offset. This approach further mitigates the risk of the offset not succeeding. These are to be detailed in an OAMP post Project approval, which will be submitted to the Department for approval. Based on the above, the Offset Management Strategy is considered to fulfil the policy principle.

Policy Principle	Justification/Relevant Section	Fulfillment of Policy Principles
Suitable offsets must be additional to what is already required, determined by law or planning regulations or agreed under other schemes or programs (this does not preclude the recognition of state or territory offsets that may be suitable as offsets under the EPBC for the same action).	Offset requirements have been calculated using the OAG (**Section 7.3** and **Appendix B**), and are additional to what is already required, determined by law or planning regulations, or agreed to under other schemes or programs. The strategy for offset delivery has been tailored for each relevant MNES and addresses opportunities for habitat quality improvement (**Section 7.3**), including key active threats identified during field survey (**Section 5.4.1.1**). These opportunities for improvement are in alignment with relevant conservation advice documents or species recovery plans. Achieving conservation gain for each MNES requires management actions that go beyond standard land management requirements, with consideration to ecosystem function and ecological processes relevant to each MNES.	All properties currently assessed for suitability to become an offset are not an existing conservation estate or receiving stewardship funding. Consequently, all assessed properties are additional to what is already required. The management actions identified to achieve a conservation gain, go beyond standard land management practice, and are tailored to each MNES, and will provide benefit more generally to terrestrial ecology values in the region. Based on the above, the Offset Management Strategy is considered to fulfil the policy principle.
Suitable offsets must be efficient, effective, timely, transparent, scientifically robust and reasonable.	Legal securement of the offset will occur within 6 months of commencement of the action, and the offset maintained or improved for the remaining duration of the approval (**Section 7.2**). Significant investigation of the offset properties has been undertaken, demonstrated within this Strategy (refer **Section 6.0** and **Section 7.0**).	All properties currently assessed for suitability to become an offset is based on accurate and dependable methods for field surveys and scientifically robust and transparent information from multiple sources. Based on the above, the Offset Management Strategy is considered to fulfil the policy principle.
Suitable offsets must have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.	An OAMP will be prepared following the approval of the Project to establish clear guidance regarding the ongoing management and monitoring requirements to improve or maintain the viability of the protected matters (**Section 9.1**). The offset will be delivered within appropriate and transparent governance arrangements as stipulated in the policy.	A detailed OAMP for the suitable offset property or properties will enable transparent governance following approval. This offset strategy provides a thorough assessment of habitat quality scoring, and identifies management actions that can be taken to achieve a conservation gain. The OAMP will clearly stipulate how conservation gain is measured and monitored. Auditing arrangements and clear identification of persons responsible for delivery of actions will be identified. Based on the above, the Offset Management Strategy is considered to fulfil the policy principle.

Policy Principle	Justification/Relevant Section	Fulfillment of Policy Principles
In assessing the suitability of an offset, government decision-making will be informed by scientifically robust information and incorporate the precautionary principle in the absence of scientific certainty.	Commonwealth approved guidance documents and additional information sources (e.g., state guidance documents and scientific literature) have been consulted throughout the environmental impact assessment process and development of the offset strategy. These information sources will be further considered when preparing the OAMP to ensure the best available scientific data and evidence are utilised to plan and deliver the offset.	All properties surveyed for potential offsets were done so via approved guidance documents and scientific literature. This strategy presents an approach based on site specific findings, using accepted methodologies and robust scoring approaches tailored for each MNES.
In assessing the suitability of an offset, government decision-making will be conducted in consistent and transparent matter.	Offset requirements have been calculated using the OAG (**Section 7.3** and **Appendix B**), which will allow the department to determine the suitability of the offset in a consistent and transparent manner.	All properties surveyed for potential offsets have been assessed using the OAG.

3.0 MNES Values

A total of 20 MNES are considered relevant to the Project and were the subject of the impact assessment (see Attachment B4 of the Preliminary Documentation). Of the 20 MNES values assessed, eight are known from the Study Area, whilst a further nine were deemed to have a high or moderate likelihood of occurrence due to nearby records and presence of habitat. Three aerial fauna species considered to have a low likelihood of occurrence, but identified on the DCCEEW Request for Additional Information as being at risk of potential operational impacts, were also assessed.

Potential Project impacts include both direct (e.g. habitat loss, collision mortality) and indirect impacts (e.g. increased predation). Attachment B4 of the Preliminary Documentation presents the full impact assessment, with the key findings summarised below in **Table 3.1**.

Table 3.1 Potential Impacts to MNES

Common Name	Habitat type	Likelihood of Occurrence Outcome	Predicted Impact Area (ha)	Significant Impact
Threatened Flora				
Cycas megacarpa	Habitat	Known	641.5	**Yes**
Quassia (*Samadera bidwillii*)	Potential habitat	Known	347.8	No
	Habitat Critical to the Survival of the Species		0.0*	
Cossinia (*Cossinia australiana*)	Potential habitat	Moderate	8.6	No
Decaspermum struckoilicum	Potential habitat		2.3	No
Threatened Fauna				
Northern quoll (*Dasyurus hallucatus*)^	Denning and refuge	Known	22.1	**Possible**
	Foraging and dispersal		574.8	No
Collared delma (*Delma torquata*)	Breeding, foraging and dispersal	Moderate	272.8	**Possible**
Red goshawk (*Erythrotriorchis radiatus*)	Foraging and dispersal	Low	633.0	No
Greater glider (southern and central) *(Petauroides volans)*	Foraging and dispersal	Known	207.4	**Likely**
	Likely/current denning		244.7	
	Potential/future denning		175.8	
Yellow-bellied glider (south-eastern) (*Petaurus australis australis*)	Breeding and denning	Known	163.3	**Likely**
	Foraging and dispersal		158.7	
Koala (*Phascolarctos cinereus*)	Breeding, foraging and dispersal	Known	641.6	**Likely**
	Climate refugia		5.3	

Common Name	Habitat type	Likelihood of Occurrence Outcome	Predicted Impact Area (ha)	Significant Impact
Squatter pigeon (southern) (*Geophaps scripta scripta*)	Breeding	Known	5.9	No
	Foraging		1.2	
	Dispersal		361.4	
Ghost bat (*Macroderma gigas*)	Seasonal foraging/dispersal only	Low	883.6	No
White-throated needletail *(Hirundapus caudacutus*)	Roosting and foraging	Known	269.6	No
	Foraging and dispersal		370.6	
Grey-headed flying-fox (*Pteropus poliocephalus*)	Foraging	Low	277.3	No
Migratory Fauna				
Fork-tailed swift (*Apus pacificus*)	Foraging and dispersal	High	883.6	No
Black-faced monarch (*Monarcha melanopsis*)	Foraging and marginal breeding	Moderate	17.7	No
	Foraging and dispersal		330.7	
Oriental cuckoo (*Cuculus optatus*)	Foraging and dispersal	Moderate	348.1	No
Rufous fantail (*Rhipidura rufifrons*)	Foraging and dispersal	Known	348.1	No
Satin flycatcher (*Myiagra cyanoleuca*)	Foraging and dispersal	Moderate	339.7	No
Spectacled monarch (*Symposiarchus trivirgatus*)	Foraging and dispersal	Known	17.9	No

^ Significant impacts for northern quoll are likely on habitat critical to the survival (breeding) only.

** Neoen have committed to avoiding habitat critical to the survival of quassia (Samadera bidwillii), approximately 0.1 ha.*

4.0 Avoidance and Mitigation

Neoen is committed to ensuring the Project follows the principles of ecologically sustainable development. In planning for and developing the Project, Neoen have implemented the hierarchy of management principles. These principles and the order in which they have been applied is as follows:

- **Avoid:** locating activities to avoid direct and indirect impacts on MNES.
- **Minimise:** minimising direct and indirect impacts where they cannot be completely avoided.
- **Mitigate:** implementing mitigation and management measures to reduce direct, indirect and cumulative impacts.
- **Remediate and Rehabilitate:** actively remediate and rehabilitate impacted areas to promote long-term recovery.
- **Offset:** where necessary, provide suitable offsets for activities that result in significant residual impacts to MNES even with the implementation of the above principles.

Further details on the avoidance and mitigation measures relevant to the Project can be found in Section 9.0 of Attachment B4 (Assessment of Matters of National Environmental Significance).

It should be noted that information provided in the subsequent sections relates to the avoidance and mitigation of all MNES to the Project.

4.1 Avoidance

The avoidance of MNES has been demonstrated since early stages of the Project, through selection of the Study Area and the design and siting of the Disturbance Footprint. Revisions to both have occurred throughout the life of the Project as a result of community and landholder consultation, wind resource data, grid connectivity options and an understanding of on-ground constraints.

An ecological constraints analysis was undertaken with the intention to determine priority avoidance areas based on the flora and fauna values, taking into consideration sensitivity levels and environmental significance. A key initial input in the constraints analysis was the delineation of remnant and regrowth habitat types from cleared areas, as well as the identification of suitability for MNES including the presence of habitat features which may be limited in the environment. Siting Project infrastructure within areas that have already been previously cleared allows for MNES values that are highly sensitive to disturbance to be avoided. Avoidance, including further avoidance strategies for *Cycas megacarpa*, is specifically detailed below.

Unnecessary vegetation clearing for some Project elements such as access tracks and laydown areas has also been avoided and habitat fragmentation impacts are minimised as the areas affected are already impacted by historical clearing and edge effects.

4.1.1 Cycas megacarpa

The avoidance of *Cycas megacarpa* has been demonstrated through both selection of the Study Area and the design of the Disturbance Footprint. Revisions to both have occurred throughout the life of the Project as a result of community and landholder consultation, wind resource data, grid connectivity options and an understanding of on-ground constraints. The Development Corridor size and configuration in particular has undergone at least three significant revisions (all of which have resulted in a reduced number of turbines) to account for impacts to *Cycas megacarpa*. Known high-density areas of *Cycas megacarpa* were prioritised for avoidance during the initial design phases. As part of ongoing avoidance measures micro-siting around Project infrastructure would further prioritise the following, where possible:

- Areas where high densities of *Cycas megacarpa* are known to occur.
- Large reproductive-age individuals (>1 m).
- Mature female plants.

Further avoidance opportunities exist for *Cycas megacarpa* with the installation of overhead powerlines, with individuals less than 4 m potentially retained in these areas. Approximately 2,883 individuals within the Disturbance Footprint are mapped under 33 kilovolt (kV) and 275 kV reticulation. The final number of *Cycas megacarpa* individuals to be avoided will be based on the final detailed design and subject to micro-siting requirements of transmission line infrastructure, Project track and hardstands. With regards to the final Project design, there are several options the Project is considering to reduce impacts to *Cycas megacarpa*. Some of these options include;

- The incorporation of civil design optimisation software which will lead to a reduction in bulk earthworks cut and fill requirements, and reduced clearance area for the Disturbance Footprint.
- Potential reductions in the width of Project access tracks and roads.
- Batter slope reduction.

The Project is currently assessing the feasibility of co-locating civil and electrical balance of plant items, and assessing 'just-in-time deliveries' of wind turbine components to minimise the need for onsite storage, reducing hardstand clearance.

4.2 Minimisation

Where avoidance was not possible for impacts to MNES, minimisation efforts have been undertaken. Vegetation clearing and the subsequent construction of the Project will occur progressively and in phases. By doing this, only a small subset of the Disturbance Footprint will be impacted at one time. Indirect impacts resulting from the construction of the Project will be localised, short-term, and actively managed.

4.3 Mitigation and Management

Throughout the life of the Project, potential impacts on MNES will be directly or indirectly managed via Project management plans (Attachment C to K of the Preliminary Documentation). Extensive mitigation and management measures relevant to MNES will be captured in one or multiple of the Project Management Plans.

Further to these plans, general and species-specific mitigation measures have been developed and are provided in Section 9.0 of Attachment B4 (Assessment of Matters of National Environmental Significance). Greater consideration has been given to MNES values that may be particularly sensitive to potential Project impacts including the endangered *Cycas megacarpa*, northern quoll, greater glider (southern and central), yellow-bellied glider (south-eastern) koala and collared delma.

General mitigation measures are split into four broad categories, vegetation, fauna, weed and pests and other impacts, and provided in Section 9.0 of Attachment B4 (Assessment of Matters of National Environmental Significance).

5.0 Offset Assessment Methodology

The methodology to identify, assess and characterise potential offset properties, is provided below. Habitat scoring methodology for impacted MNES values is also provided. The broad methodology followed and presented in the below sections include:

1. Identification of potential properties, suitable for use as an offset. Properties within 20 km of the Project were targeted.
2. Characterisation of potential properties, comprising:
    i. Desktop assessment for suitable values, comprising 'like for like' with significantly impacted MNES.
    ii. Field assessment, comprising both rapid and detailed techniques, such as targeted threatened species survey, vegetation validation / mapping and habitat assessment.
    iii. Habitat quality assessment within representative areas (matter units / assessment units).
3. Habitat quality scoring, using standard and modified scoring methodologies.

5.1 Identification of Offset

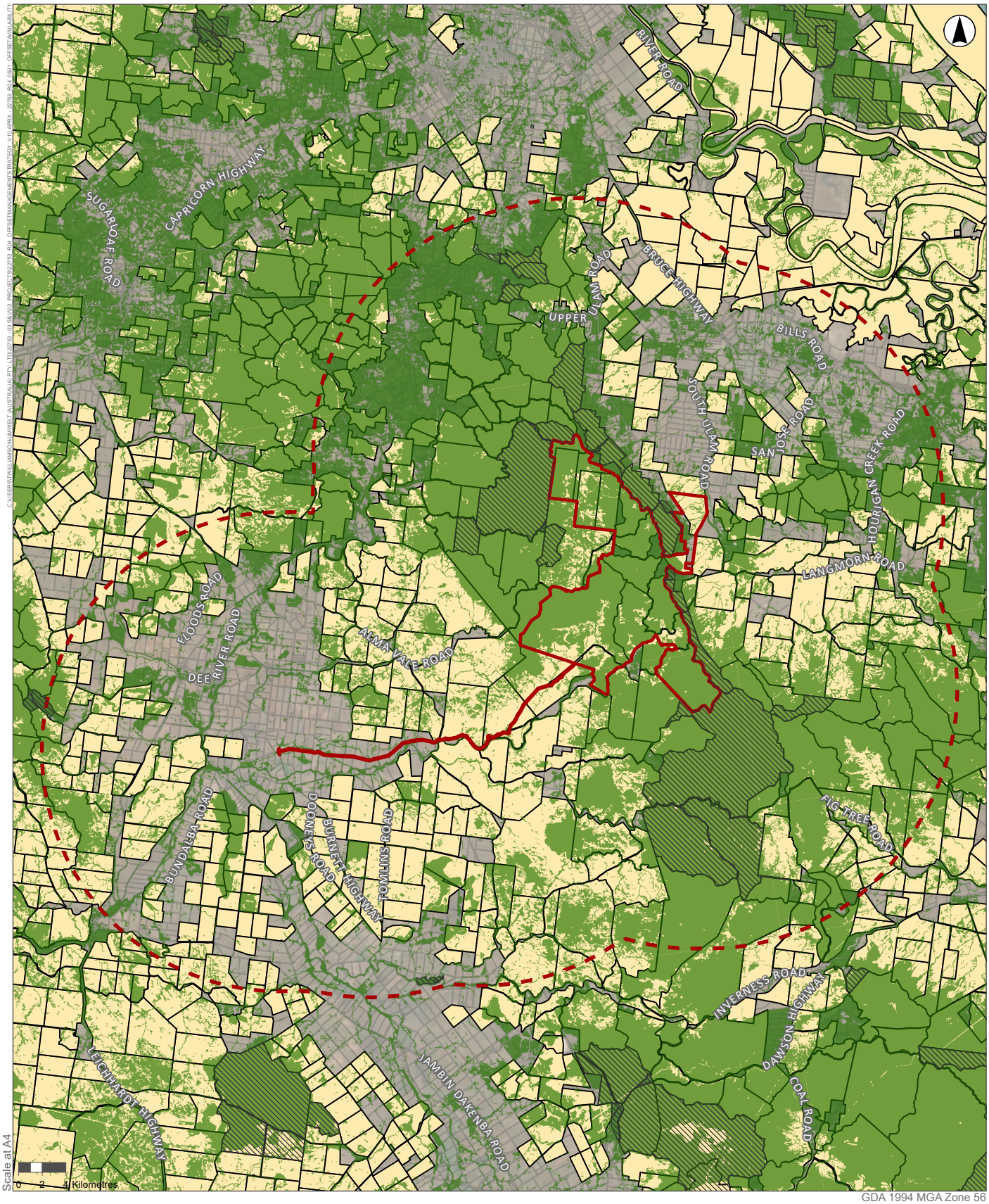
The proposed approach to securing offsets for the Project is the securement of land within the region that supports habitat for the impacted MNES and is suitable to deliver offsets in accordance with the Offset Policy. Securement of suitable land proximal to the Project is the preferred option, due to proximity to impact value (i.e. offset will benefit locally impacted values) and a high degree of confidence that target MNES values or habitat is present. To this end, properties within 20 km were assessed for suitability. Properties which intersected state significant corridors or exhibited connective vegetation with corridors or protected estate were also preferentially targeted.

Based on a 20 km search radius, five property options were identified as holding potential to contribute to the project offset portfolio. These properties have been investigated in terms of their suitability and availability for providing the required offsets. The properties are herein referred as properties:

- R1 and R2, noted for rapid and targeted field survey, with partial ground truthed vegetation datasets.
- F1, F2 and F3, noted for rapid and targeted field survey, full ground truthed mapping datasets and habitat quality assessments within representative assessment units.

The final offset property area is subject to landholder negotiations, presence and conditions of ecological values and environmental management requirements. It is also noted that properties within the broader region have and will continue to be investigated for offset suitability.

Figure 5.1 presents suitable land parcels containing woody vegetation within 20 km of the Study area, where as **Figure 5.2** depicts relevant habitat corridors. The five properties presented in this report are situated within this area. Further detail as to the suitability of habitat across these properties is detailed in **Section 6.0**.



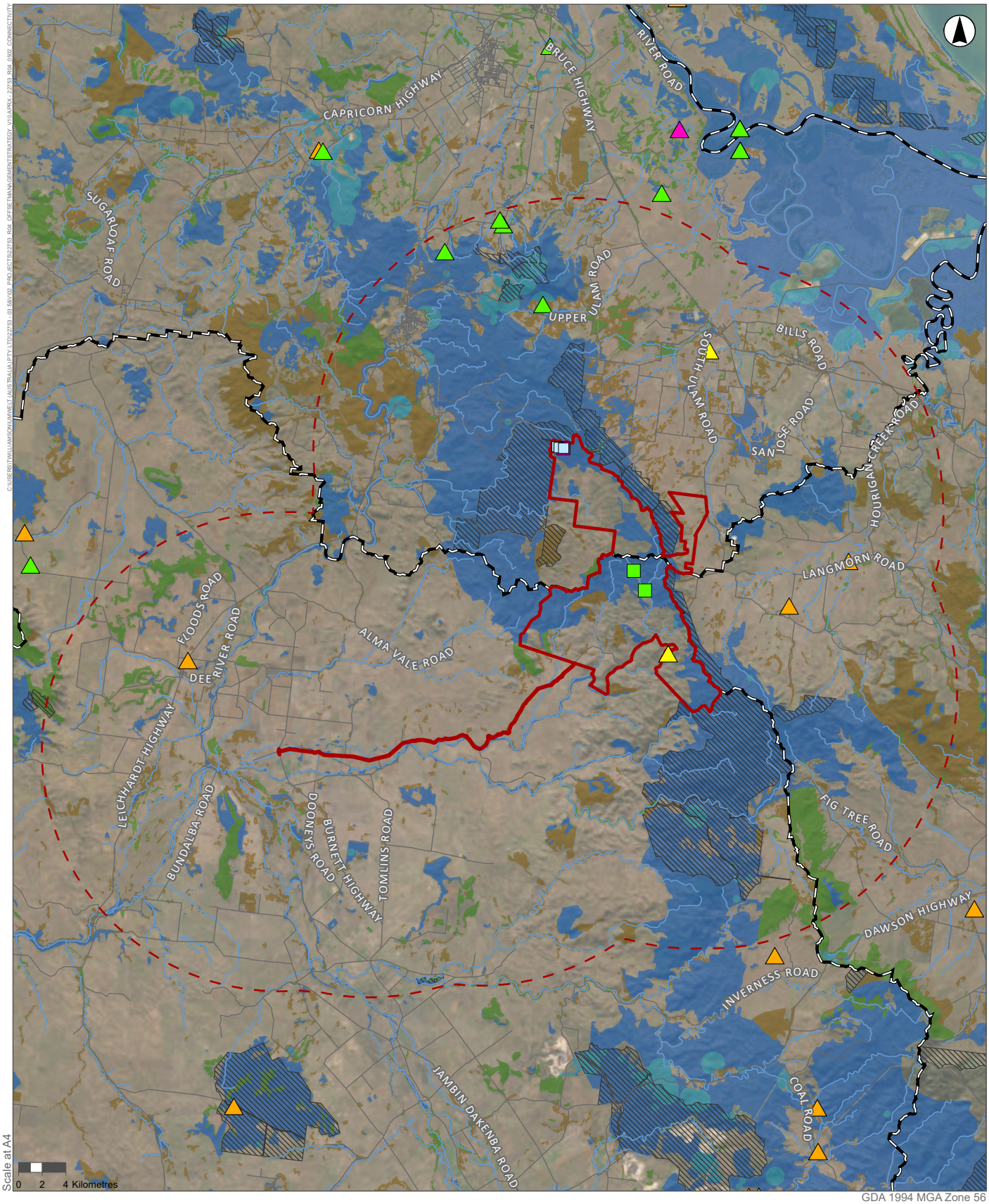
Legend

- Study Area
- Study Area Buffer (20km)
- Suitable Land Parcels
- Woody Vegetation
- Protected Areas

FIGURE 5.1

OFFSET AVAILABILITY

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)



Legend

- Study Area
- Study Area Buffer (20km)
- Local Government Area (LGA)
- Protected Areas
- Roads
- Watercourse

Biodiversity Significance

- State Habitat for Endangered, Vulnerable or Near Threatened (EVNT) taxa
- State
- Regional
- Local or Other Values

Umwelt Records (Study Area Only)

- Greater Glider (Southern and Central) Record (Umwelt)
- Northern Quoll Records (Umwelt)
- Yellow-bellied Glider (south-eastern) Record (Umwelt)

ALA Records

- Greater Glider (Southern and Central) Record (ALA)
- Northern Quoll Record (ALA)
- Collared Delma Record (ALA)
- Koala Record (ALA)

FIGURE 5.2

CONNECTIVITY

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)

5.2 Offset Property Characterisation

5.2.1 Desktop Assessment

A desktop assessment was completed for each proposed offset property using a two-step process. The first step involved a Geographic Information System (GIS) spatial analysis to determine the extent of available land within each proposed offset property. For properties where Project infrastructure may co-occur, a 30-metre (m) buffer was applied to the Development Corridor, to exclude areas of habitat potentially subject to edge effects. Only habitat outside of this buffer was considered for offset purposes. This buffer is indicative only, the requirement for and / or the final buffer distance will be determined as part of the OAMP in consultation with DCCEEW, giving consideration to the relevant MNES values. The general size and shape of the available offset areas was then reviewed, with narrow, oddly shaped and or small patches (<20 ha) excluded.

The second step comprised a broader assessment of desktop values, including a review of mapped vegetation, waterways, connectivity value, overlap with species records and mapped occurrence of essential habitat / protected plant trigger areas. To determine the presence of suitable habitat relevant to significantly impacted MNES, a review of existing field-validated data (where available) including vegetation and habitat mapping was conducted. Where field-validated data was unavailable, dominant remnant and high-value regrowth vegetation communities (as mapped by State vegetation layers) were used to determine the likelihood of habitat being present. Areas of suitable vegetation synonymous with MNES habitat were then mapped.

5.2.2 Field Assessment (Rapid and Detailed Assessment)

For three of the five offset properties, the delineation of broad assessment units was identified and mapped for validation via field survey. The field assessment comprised a combination of field techniques, including both rapid and detailed methods, in some instances conducted over a period of three years as part of a broader baseline assessment of values. The assessment methods applied within each property are summarised in **Table 5.1** below. Field surveys were undertaken using methods consistent with those used during impact area surveys.

Table 5.1 Sampling Method Within Identified Offset Property

Sampling Method	Proposed Offset Property				
	R1	R2	F1	F2	F3
Desktop assessment	Yes	Yes	Yes	Yes	Yes
Rapid field survey to validate desktop	Yes	Yes	Yes	Yes	Yes
Ground truth vegetation/habitat assessment (partial)	Yes	Yes	Yes	Yes	Yes
Ground truth vegetation/habitat assessment (complete)	No	No	Yes	Yes	Yes
Targeted threatened flora survey	Yes	Yes	Yes	Yes	Yes
Targeted threatened fauna survey	No	Yes	Yes	Yes	Yes
Habitat Quality Assessment	No	No	Yes	Yes	Yes

The full methodology of assessment is not provided in this Offset Management Strategy. For ground-truth vegetation and habitat assessment, targeted threatened flora survey and targeted threatened fauna survey, methods are consistent with those presented in Section 4.0 of Attachment B1 (Assessment of Matters of National Environmental Significance). For habitat quality assessments, a high level summary of methodology, including for scoring is provided in the below sections.

5.2.3 Field Survey Effort

A total of 105 habitat quality assessments were completed throughout the impact and proposed offset properties. **Table 5.2** presents the number of habitat quality assessments conducted within the impact and offset areas of each matter unit. Further detail regarding the approach to habitat quality assessment and scoring is provided in **Section 5.3** and **Section 5.3.2** below.

Table 5.2 Summary of the Habitat Quality Field Surveys Conducted throughout the Impact and Offset Areas

Matter	Matter Unit	Impact	Offset (F1, F2, F3)
Cycas megacarpa	Mapped habitat	24	49
Northern quoll	Denning and refuge	2	17
Greater glider (southern and central)	Forging and dispersal	8	15
	Potential/ future breeding and denning	4	17
	Likely/ current breeding and denning	10	25
Yellow-bellied glider (south-eastern)	Breeding and denning	8	24
	Foraging and dispersal	6	21
Koala	Climate refugia	3	10
	Breeding, foraging and dispersal	22	50
Collared delma	Breeding and foraging	12	38

5.3 Habitat Quality Assessment

This section provides a high-level summary of the habitat quality assessment methodology applied to the disturbance footprint (impact area) as well as proposed offset properties, F1, F2 and F3. For the purposes of this Offset Management Strategy, the combined effort or approach is presented for the impact and offset (collective), rather than breakdown to individual property level. The OAMP will provide the score breakdown for the final offset area.

5.3.1 Delineation of Matter Unit and Assessment Unit

Prior to the habitat quality assessment surveys, the matter unit (MU) and assessment unit (AU) were delineated and mapped to inform field survey and ensure adequate sampling replication throughout the proposed offset areas. Delineation of units were consistent with the impact site, following the below approach:

- Matter Unit – being the habitat utilisation type of the target MNES Matter, i.e. northern quoll denning and refuge habitat.
- Assessment unit – Condition types mapped within the mapped area of the matter unit. i.e. remnant vegetation of northern quoll denning and refuge habitat.

Matter units were delineated within impact and offset areas as per the habitat mapping rules (**Appendix A**) developed for the EPBC impact assessment (Umwelt, 2023). Habitat mapping rules incorporated species-specific habitat requirements derived from scientific literature, and relevant Conservation Advice and Recovery Plans (*EPBC, 1999*). These included patch size thresholds, tree size thresholds, presence of breeding features, RE classifications, vegetation maturity condition, abundance and/or density of rocky outcrops, coarse and fine woody debris, leaf litter and other foraging microhabitat. A detailed definition of the habitat mapping rules is provided within Attachment B4 – Assessments of Matters of National Environmental Significance Preliminary Documentation 2021/9137 Appendix E – Habitat Assessments for Matters of National Environmental Significance (Umwelt, 2023).

In addition, areas within the potential offset were classified as 'emerging habitat' which represents areas that do not currently provide habitat to a species but are expected to within 20 years if threat abatement and/or restorative management actions are effectively enacted. Emerging habitat was classified as a unique assessment unit and area-weighted accordingly. The inclusion of emerging habitat will by definition, provide the lowest habitat quality score and therefore decrease the starting offset habitat quality score for that matter but, will also provide the greatest opportunity for conservation gain and increase of a species' habitat over the life of the offset.

5.3.2 Field Survey Methodology

The field survey methodology was developed and applied with consideration of:

- EPBC Act Environmental Offsets Policy.
- DCCEEW's 'How to use the Offsets Assessment Guide'.
- Queensland Guide to determining terrestrial habitat quality (version 1.2).
- Modified habitat quality assessment scoring spreadsheet (MHQA) as provided by DCCEEW (2 May 2023).

The EPBC Act policy and associated guide, listed above, provide the key indicators for determining habitat quality within the impact and offset areas, these are:

- Site condition: This is the condition of a site in relation to the ecological requirements of a threatened species or ecological community. This includes considerations such as vegetation condition and structure, the diversity of habitat species present, and the number of relevant habitat features.
- Site context: This is the relative importance of a site in terms of its position in the landscape, taking into account the connectivity needs of a threatened species or ecological community.
- Species stocking rate: This is the usage and/or density of a species at a particular site.

The collection of field data associated with the above habitat quality attributes, followed the methodology prescribed in the Queensland *Guide to determining terrestrial habitat quality (version 1.2*), except where departures were necessary to address requirements of the Offset Policy and DCCEEW MHQA scoring approach. This includes the incorporation of species-specific habitat attributes into site condition and site context, justified rules around threats and mobility capacity for threatened fauna context assessments and criteria to adequately score aspects of the species stocking rate.

Species specific habitat attributes relevant to site condition scoring (as per the MHQA) include:

- The *quality and availability of food and foraging habitat*, (fauna only), developed in accordance with the methodology provided in the Queensland guide.
- The *quality and availability of shelter*, (fauna only), developed in accordance with the methodology provided in the Queensland guide. The attribute extends to the quality and availability of breeding habitat, noting the overlap between shelter and breeding requirements for the impacted MNES.

As well as the above, specific field assessment and justification were developed for site context attributes, comprising:

- Species mobility capacity, this attribute considered the quality and availability of habitat for mobility and incorporated site-specific field data as well as other measures. The attribute was tailored to each impacted MNES. Further detail on how this attribute was applied to the final scoring process is provided in **Section 5.4.3**.
- Threat to species, this attribute was tailored to each impacted MNES and incorporated field verified data specific to the offset property. Further detail on how this attribute was applied to the final scoring process is provided in **Section 5.4.1.1**.

5.4 Habitat Quality Scoring

The habitat quality of the impact and potential offset areas were calculated as per the MHQA to inform the Offsets Assessment Guide (*Environmental Protection and Biodiversity Conservation,* 1999). This method evaluates the site condition, site context and species stocking rate to provide a habitat quality score (HQS) out of 10, each of which have a set of sub-attributes which are further discussed in the below sections. The MHQA methodology stipulates attributes common to all fauna and flora species and, species-specific attributes. The attributes common to all species will be presented first, followed by the tailored attributes developed to measure the foraging, shelter and breeding, and mobility for the fauna species and species stocking rate for *Cycas megacarpa*.

5.4.1 Site Condition and Site Context

As per the MHQA, the site condition and site context attributes each contribute 30 % weighting to the final habitat quality score. The relevant sub-attributes and associated maximum scores are provided in **Table 5.3** below.

The methodology the scoring of sub-attributes is also provided. Scoring for the vegetation components of site condition, was completed in accordance with the vegetation component of the Guide to Determining Terrestrial Habitat Quality v1.2 (Queensland guide) (Department of Heritage and Protection, 2014) and is aligned with the MHQA. Whereas, tailored data collection for Site Condition sub-attributes: 'Quality and Availability of Food and Foraging Habitat' and 'Quality and Availability of Shelter; and Site Context sub-attributes: 'Threats to species' and 'Species mobility capacity' were consistent with the Queensland guide and scoring undertaken as per the MHQA. **Table 5.3** presents the HQS component and weighting attributes and sub-attributes collected during field surveys and subsequent spatial analysis.

Table 5.3 Summary of the Site Condition and Site Context Sub-Attributes

HQS Component & Weighting	Sub-Attribute	Methodology Notes and Source	Maximum Score
Site condition 3/10	Number of large native trees	As per Queensland Guide (Department of Heritage and Protection, 2014) These attributes area measured for all flora and fauna matters	15
	Tree canopy height		5
	Recruitment of woody perennial species (in EDL) (%)		5
	Tree canopy cover		5
	Native shrub layer cover (%)		5
	Coarse woody debris		5
	Native tree species richness		5
	Native shrub species richness		5
	Native grass species richness		5
	Native forbs/other species richness		5
	Non-native plant cover (%)		10
	Native perennial grass cover (%)		5
	Organic litter cover (%)		5
	Threatened Flora Total		**80**
	Quality and Availability of Food and Foraging Habitat	Threatened fauna only, as per MHQA (refer **Section 5.4.3**)	10
	Quality and Availability of Shelter		10
	Threatened Fauna Total		**100**
Site context 3/10	Size of patch	As per MHQA These attributes are measured for all flora and fauna matters	10
	Connectedness		5
	Context		5
	Ecological corridors	As per DEHP, 2017 These attributes are measured for all flora and fauna matters	6
	Role of site location to species overall population in the state		5
	Threats to species	As per MHQA (refer **Section 5.4.1.1**) These attributes are measured for all flora and fauna matters	15

HQS Component & Weighting	Sub-Attribute	Methodology Notes and Source	Maximum Score
	Threatened Flora Total		**46**
	Species mobility capacity *excluded for plants and communities	As per MHQA (refer **Section 5.4.3**)	10
	Threatened Fauna Total		**56**

5.4.1.1 Threats to Species

To suitably assess threats on MNES and incorporate relevant scoring into the final habitat quality score, threats matrices which measure the scope and severity of the primary threatening processes as described in the relevant EPBC Conservation Advice and/ or Recovery Plan for impacted MNES were developed.

The threat scope indicates the likelihood of the threat impacting the species whilst the threat severity indicates the expected consequence of the threat eventuating on the population. A minimum of two threats were measured for each species and included wildfire, habitat clearing, feral animal predation and cane toad poisoning. Each threat score was derived from the assessment of scope and severity. The scope includes factors which contribute to the likelihood of the threat eventuating/ effecting the matter whilst the severity factors contribute to the expected consequence that the threat would have on the population of the matter. Each of the threats relevant to a species was assessed at a monitoring site level resulting in two to four threat scores for each species per monitoring site. The lowest scoring threat score (most detrimental threat) for each monitoring site counted towards the final habitat score for the species. Consequently, the final threat score for each matter represents the average threat score of the most severe threat at each monitoring site throughout the species habitat. As a result, management actions will need to be directed and abate each threat throughout the offset area to result in a substantial habitat quality score improvement.

A summary of the relevance and methodology to measure each of the four threats is presented below. Each identified threat is known to be active within both the impact and proposed offset properties.

Table 5.4 Summary of Threats on MNEs within the Offset Properties

Threat	Relevant MNES	Scope / Severity	Contributing Factors
Wildfire	*Cycas megacarpa*	Scope	The fuel load associated with the vegetation hazard class (VHC) of the patch that the monitoring site is located within. Proximity of firebreaks to the monitoring site. Availability of access for emergency response personnel. Fire management regime in accordance with RE recommended guidelines.
		Severity	The fuel load associated with the VHC) of the patch that the monitoring site is located within. Whether the species is arboreal and therefore less capable to retreat into connected refuge. The size of the patch considering that the fire intensity increases with patch size.

Threat	Relevant MNES	Scope / Severity	Contributing Factors
	Greater glider (southern and central), Koala, Northern Quoll, Yellow-bellied glider (south-eastern), Collared delma	Scope	The fuel load associated with the vegetation hazard class (VHC) of the patch that the monitoring site is located within. Proximity of firebreaks to the monitoring site. Availability of access for emergency response personnel. Fire management regime in accordance with RE recommended guidelines. The sensitivity of each species to fire as described in the EPBC Conservation Advice or Recovery Plan.
		Severity	The fuel load associated with the VHC) of the patch that the monitoring site is located within. Whether the species is arboreal and therefore less capable to retreat into connected refuge. The size of the patch considering that the fire intensity increases with patch size.
Habitat clearing	*Cycas megacarpa*	Scope	The level of statutory protection of an area as classified by Qld state mapping.
		Severity	The importance of an area to each species as classified via distribution and density mapping for the species.
	Greater glider (southern and central), Koala, Yellow-bellied glider (south-eastern), Collared delma	Scope	The level of statutory protection of an area as classified by Qld state mapping.
		Severity	The importance of an area to each species as classified through ground-truthed surveys and subsequent habitat mapping.
Feral animal predation	Greater glider (southern and central), Koala, Northern Quoll, Yellow-bellied glider (south-eastern)	Scope	The presence of feral predators. Extent of feral animal management. The species' vulnerability to feral animal predation.
		Severity	The species' behaviour and particularly, duration and frequency on ground where they could be preyed upon. The sensitivity of each species to fire as described in the EPBC Conservation Advice or Recovery Plan.
Cane toad	Northern quoll	Scope	Maturity of vegetation. Severity of vegetation degradation. Proximity to watercourse. Elevation.
		Severity	Historical exposure to cane toads. Species' habitat type. Availability of alternative food and habitat.

Wildfire

Wildfire has the capacity to degrade the habitat quality of all species or in extreme cases, completely remove habitat of the three arboreal mammal species (greater glider (southern and central), koala and yellow-bellied glider (south-eastern)), or result in mortality events of individuals (e.g. *Cycas megacarpa*).

The severity of wildfire was calculated based on the species' sensitivity to the threat, fuel load of the area that the monitoring site is located within and vegetation patch size. Wildfire is referenced in EPBC documentation as a critical risk for all species excluding the northern quoll. To ascertain fuel load, a vegetation hazard class (VHC) was applied to the corresponding vegetation community of each mapped assessment units (refer **Table 5.5**). Each VHC has an associated potential fuel load in t/ha for both the remnant and regrowth maturity level (Queensland Fire and Emergency Services [QFES], 2018). The scope of the threat was scored according to the fuel load of the area that the habitat quality assessment site is located within, presence of fire breaks, tracks and/or modified grassland that could provide access to emergency personnel and whether fire management consistent guidelines were in place. The size of contiguous patch was calculated within the severity scoring with fire intensity expected to increase with patch size (QFES, 2018).

In summary, arboreal species with a high sensitivity to fire situated within large contiguous patches of high fuel-load vegetation without any firebreaks or fire management consistent recommendations scored the lowest threat score (1/15) for this threat.

Table 5.5 Summary of VHC and the Associated Fuel Loads

RE	VHC	VHC Description	Fuel Load t/ha	
			Remnant	Regrowth
11.11.5, 11.11.5a, 11.12.4	7.1	Semi-evergreen to deciduous microphyll vine forest	6	12
11.11.3, 11.12.6, 11.12.6a	10.1	Spotted gum dominated open forests	20.8	20.8
11.12.1	11.2	Moist to dry eucalypt woodlands on basalt areas	13	13
11.11.15, 11.11.3c, 11.11.4, 11.11.4a, 11.11.4b, 11.11.4c	13.2	Dry to moist eucalypt woodlands on undulating metamorphics and granite	14.4	14.4
11.3.25, 11.3.4	16.1	Eucalyptus dominated forest on drainage lines and alluvial plains	16	16
11.3.25b, 11.3.3	16.2	Eucalyptus dominated woodland on drainage lines and alluvial plains	11.6	11.6

Habitat Clearing

Habitat clearing is considered a critical threat to all six species and was therefore scored for each.
The scope was evaluated by the statutory protection currently in place over an area as indicated by the Regulated Vegetation mapping assuming that areas classified as non-remnant/ Category X vegetation (VM Act, 1999) are more likely to be cleared than high-value regrowth/ Category C and remnant/ Category B vegetation. The severity score for threatened fauna was calculated based on the vegetation's habitat value including the ground-truthed vegetation condition, proximity to waterways and the habitat type class for each species e.g. breeding and denning habitat, foraging and dispersal habitat etc. For *Cycas megacarpa*, the severity score was based on the estimated density / projected number of individuals impacted, with high density areas being the greatest risk of clearing impact.

In summary, high-value habitat areas such as breeding or refuge habitat that are subject to logging and/or mapped as Category X scored the least (1/15) for this threat.

Feral Animal Predation

Feral animal predation and to a lesser extent, competition is relevant to the greater glider (southern and central), koala, northern quoll and yellow-bellied glider (south-eastern) however, considered of less significance than other threats within the EPBC documents. The scope of the threat was scored according to the presence of feral dogs, cats or foxes, each threatened species' susceptibility to predation as described in EPBC documentation and the extent and during of management and monitoring actions relative to each monitoring site. The severity was measured based on the exposure of each threatened species to predation measured by the frequency and duration that the species is on the ground, expected presence of feral predators and time since the previous fire which is relevant to the glider species. Therefore, minimum scores resulted if no feral animal monitoring or management were in place, the species' is expected to be on the ground frequently, is commonly preyed upon by cats, dogs or foxes and/or the site has been recently burnt.

Cane Toad

Cane toad poisoning through ingestion was measured for the northern quoll as it is referenced as the most critical threat to the species within the National Recovery Plan (Department of Natural Resources, Environment, The Arts and Sport, 2010). A cane toad risk model was created for the study area which considers elevation, distance to mapped watercourses and vegetation maturity as a proxy for disturbance level. The severity score accounted for whether the norther quoll population within the study area had been exposed to cane toads and the quality and availability of alternative food and habitat required for foraging, management actions in place to control the spread of cane toads into north quoll breeding habitat. In summary, a minimum score was attributed to a site if it was within cleared land, nearby a watercourse at an elevation below 450 m and field surveys reported 'absent' or 'rare' foraging microhabitat.

5.4.2 Species Stocking Rate

The species stocking rate is the third component of habitat quality and contributes 40% to the final habitat quality score (as per the MHQA). Species stocking rate sub-attributes measure the presence, usage and importance of the population to give an indication of the site's carrying capacity and significance to each species' overall survival. Four attributes were assessed to provide a maximum score of 70, subsequently converted to a score out of 5. As per the MHQA, the approach to species stocking rate differs between threatened fauna and threatened flora, the approach for each species is presented in the sections below.

5.4.2.1 Threatened Fauna

The breakdown of species stocking rate sub-attributes and associated maximum scores for threatened fauna are provided below in **Table 5.6**.

Table 5.6 Summary of the Species Stocking Rate Sub-Attributes (Threatened Fauna)

HQS Component and Weighting	Sub-Attribute		Scoring Method	Maximum Score
Species Stocking Rate 4/10	Presence detected on or adjacent to site (neighbouring property with connecting habitat)		MHQA (refer below)	**10**
	Species usage of the site (habitat type and evidence usage)		MHQA (comprise specific criteria, refer **Section 5.4.3**)	**15**
	Approximate Density		MHQA (refer below)	**30**
	• Role/ importance of species population on site.		MHQA (scored at matter level for each MNES, refer **Section 5.4.3**)	**15**
	Supplementary Table	• Key source for population breeding.		(10)
		• Key source for dispersal.		(5)
		• Necessary for maintaining genetic diversity.		(15)
		• Near the limit of the species' range.		(15)
	Total		**70**	

Presence Detected on or Adjacent to Site

For assessing threatened fauna species, this attribute is scored on detection per habitat patch with the maximum score allocated if the specie s has been recorded within the patch whilst half the score is allocated if the species has been detected within the impact Study Area or offset area (**Table 5.7**).

Table 5.7 Detection Classes Applicable to the SSR

Matter	Score		
	0	5	10
Threatened fauna species	No detections within assessment unit or adjacent properties	No detections within mapped habitat patch, detection within Study area / Offset area	Detected within mapped habitat patch

Species Usage

Species usage criteria was developed for each species incorporating the habitat mapping and species-specific habitat quality assessments. Scoring for species was classified across three broad categories including, limited, moderate or high usage.

Given the specific nature of this component, the approach to species usage for each relevant MNES is presented **Section 5.4.3**.

Approximate Density

Targeted surveys were undertaken using best-practice methods aimed at maximising the detectability of MNES. This included appropriate survey timing and search effort, conducted seasonally and over multiple years. The surveys confirmed the presence of MNES within the Study Area, as well as the proposed offset areas. On many occasions surveys returned a low number of records (e.g. northern quoll) or an absence of records of the impacted MNES (e.g. collared delma). Deriving density data from these records, as well as noting the absence of publicly available, proximal data from a reference population, is not considered suitable. Despite this, carry capacity is able to be assessed, and used to proportionally infer a density.

For the purposes of the Offset Management Strategy, carrying capacity is defined as a species' average population size in a particular habitat. A species population size is limited by environmental factors including food availability (inferred by foraging habitat), quality and availability of shelter and breeding resources as well as a sites dispersal potential and connectedness. It is reasonable to assume that the relative condition of key measures for foraging habitat, shelter, breeding and mobility infer the potential carrying capacity of a site. That being, the absence or limited availability of resources would indicate an absence of the species or low-density population; whereas the inverse being an abundance of high quality resources would indicate potential presence and infer an ability to support the highest possible density for that location.

For the reasons above, the approximate density was inferred from species specific habitat quality metrics which inform carrying capacity. Specifically the following sub-attributes:

- Quality and availability of food and foraging habitat.
- Quality and availability of shelter.
- Species mobility capacity.

For threatened fauna species, the above sub-attributes scores were calculated as a proportion of the maximum score obtainable. The resultant proportion was then used to determine the approximate density score (refer **Table 5.8**).

This approach to approximate density provides incentive for positive, on-ground outcomes which will have a net benefit for the impact MNES. By focussing management measures to key aspects which directly influence a sites carry capacity, conservation gains are able to be realised.

Table 5.8 Approximate Density Classes

Matter	0	10	20	30
Threatened fauna	The site scored <25% of the max	25 to 50% of the max	>50% to 75% of the max	>75% of the max

Role and Importance of the Species Population on Site – SSR Supplementary Table

The species stocking rate supplementary scoring table has been derived using field verified data, as well as habitat mapping and species assessment information collected for the Project. The outputs of this assessment, including brief justification is provided in for each relevant MNES is presented **Section 5.4.3**.

5.4.2.2 Cycas megacarpa

Species stocking rate for threatened flora is scored as per the sub-attributes in **Table 5.9** below. Given the distribution of the *Cycas megacarpa* throughout the impact and offset areas, a single species stocking rate score can be applied to all habitat quality assessment sites that exist within mapped *Cycas megacarpa* habitat.

Table 5.9 Summary of the Species Stocking Rate Sub-Attributes (Threatened Flora)

HQS Component and Weighting	Sub-Attribute		Scoring Method	Maximum Score
Species Stocking Rate 4/10	Presence detected on or adjacent to site (neighbouring property with connecting habitat)		MHQA	10
	Number of plants on site			30
	Extent of population on site (ha)			30
	Approximate density (per ha) over suitable habitat within project area			20
	Role/ importance of species population on site		MHQA (refer supplementary table)	15
	Supplementary Table	Key source population for germination and seed/gamete dispersal		(10)
		Necessary for maintaining genetic diversity		(5)
		Near the limit of the species' range		(15)
	Total		**105**	

Scoring for *Cycas megacarpa* species stocking rate was 3.2/4 and made on the following basis:

- Presence detected on or adjacent to site (neighbouring property with connecting habitat).
    - Maximum score of 10 achieved, with *Cycas megacarpa* confirmed within impact area and all offset properties.
- Number of plants on site.
    - Maximum score of 30 achieved for both impact and offset.
        - The estimated number of individuals for the Study Area (hosts the impact) is 141,392.
        - The estimated number of individuals for the proposed offset area is 131,990.
- Extent of population on site (ha)
    - Maximum score of 30 achieved with the extent of population within the impact and offset areas exceeding 60 ha.
        - Estimated extent of population in the Study Area is 11,528.4 ha.
        - Estimated extent of population in the proposed offset area is 17,351 ha.

- Approximate density (per ha) over suitable habitat within project area.
    - Score of 5 achieved for impact site, with approximate density over suitable habitat comprising 19.1 plants per ha.
    - Score of 5 achieved for the proposed offset area, with approximate density over suitable habitat comprising 8 plants per ha.
- Role/ importance of species population on site.
    - Achieved score of 10 for impact and proposed offset area, based on following supplementary responses.
        - Key source population for germination and seed/gamete dispersal. Yes – Score of 10.
        - Necessary for maintaining genetic diversity. Yes – Score of 15
        - Near the limit of the species' range. No – Score of 0.

5.4.3 Species Specific Habitat Quality Attributes

As per the Queensland Guide and MHQA, tailored habitat quality scoring metrics were developed for aspects of:

- Site condition, comprising sub-attributes 'quality and availability of food and foraging habitat ' and 'quality and availability of shelter'.
- Site context, comprising sub-attributes 'mobility capacity' and 'threats'.
- Species stocking rate, comprising sub-attributes for 'species usage' and 'role and importance of the species population on site'.

Species specific habitat quality attributes, relevant to habitat quality scoring for MNES are detailed in the sections below.

5.4.3.1 Northern Quoll

Site Condition and Site Context

The northern quoll occupies a diversity of habitats including rocky areas, eucalypt forest and woodlands, rainforests, sandy lowlands and beaches, shrubland, grasslands and desert (Department of Natural Resources, Environment, The Arts and Sport, 2010). Habitat generally encompasses some form of rocky area for denning purposes with surrounding vegetated habitats used for foraging and dispersal (DNREAS, 2010).

Having regard for the above, the degree of connectivity of breeding and denning habitat to adjacent vegetation was measured to determine quality and availability of mobility habitat. Suitable denning and refuge habitats usually have a high structural diversity and contain microhabitat features such as large diameter trees, termite mounds or hollow logs and therefore are measured as sub-attributes within the quality and availability of shelter and breeding habitat (DNREAS, 2010). Finally, northern quolls are opportunistic omnivores, which consume a wide range of pretty items including invertebrates, carrion, fruit nectar, mammals, birds, reptiles and frogs (DNREAS, 2010). Therefore, abundance of structural and compositionally microhabitat including fallen timber, organic litter, rocky scree etc. was measured to determine the quality and availability of food and habitat required for foraging.

Table 5.10 presents the species-specific habitat quality attributes measured within the site condition and site context of the MHQA.

Table 5.10 Northern quoll Species-Specific Habitat Quality Attributes Calculated Towards the Site Condition and Site Context Component of the MHQS

MHQA Component	Sub-Attribute	Species-Specific Indicator	Maximum Score
Site condition	Quality and availability of food and foraging habitat	Abundance of suitable microhabitat for prey species (hollows, hollow logs, fallen timber, rocks, coarse woody debris, organic litter)	10
	Quality and availability of shelter	Abundance of large hollow logs	2
		Density of large trees (Benchmark)	2
		Abundance of termite mounds	1
		Abundance of rocky outcrops and rock crevices	5
Site context	Species mobility capacity	Habitat patch connectivity	10
	Threats	Feral animal predation	15
		Cane toads	
		Abundance of suitable microhabitat for prey species (hollows, hollow logs, fallen timber, rocks, coarse woody debris, organic litter)	

Species Stocking Rate – Species Usage

The northern quoll is mapped as having a single habitat type and therefore were assigned the maximum species usage score.

Species Stocking Rate – Role and Importance of the Species Population on Site (SSR Supplementary Table)

Relevant to the northern quoll and scored at a matter level for the entire assessment unit, the scoring for the attribute Role and Importance of the Species Population on Site (SSR Supplementary Table), followed the below:

- Key source for population breeding: 10/10, persisted in Queensland following exposure to cane toad threat.
- Key source population for dispersal: 5/5, due to occurrence within mapped biodiversity corridor.
- Necessary for maintaining genetic diversity: 15/15, Rocky areas with varying cane toad density, potential key genetic source linking Mount Morgan and Kroombit Tops National Park population.
- Near the limit of the species range: 0/15, due to not occurring near the limit of the species range.

5.4.3.2 Greater Glider (Southern and Central)

Site Condition and Site Context

Greater gliders favour forests with a diversity of eucalypt species due to seasonal variation in its preferred foraging tree species (Eyre et. al, 2022). As such, habitat quality, as it relates to foraging, can be measured, on the abundance, density and cover of foraging resources, but also through the diversity of foraging tree species. Within the Brigalow Belt Bioregion, a number of tree species have been identified as dominant or co-dominant species in greater glider (southern and central) habitat, including (in descending order of extent): *Eucalyptus crebra, Corymbia citriodora, Eucalyptus tereticornis, Corymbia clarksoniana, Eucalyptus moluccana, Corymbia intermedia, Eucalyptus acmenoides, Lophostemon suaveolens and Corymbia trachyphloia* (Department of the Environment and Science 2022). Moreover, hollow-bearing trees are an essential structural element, that provide sheltering and breeding resources for greater gliders. Greater glider tree usage correlates with tree size with trees >30 cm diameter at breast height (DBH) measured to indicate foraging habitat and the density of trees >50 cm DBH measured to indicated denning habitat (Eyre et. Al, 2022). Finally, patch size is expected to influence the occupancy and persistence of greater gliders with research indicating the occupation of a small home range (<3 ha) suggesting the species can occupy relatively small patches albeit at a lower likelihood and density (Eyre et. Al, 2022). Therefore, vegetation condition and habitat patch size were used to score the mobility habitat. **Table 5.11** presents the species-specific habitat quality attributes including presence of large trees, habitat trees and size of patch used to measure the species-specific sub-attributes of site condition and site context in accordance with the MHQA.

Table 5.11 Greater glider (southern and central) Species-Specific Habitat Quality Attributes Calculated Towards the Site Condition and Site Context Component of the MHQA

MHQA component	Sub-Attribute	Species-Specific Indicator	Maximum Score
Site condition	Quality and availability of food and foraging habitat	Density of large trees (>30 cm dbh)	5
		Species richness of habitat trees	5
	Quality and availability of shelter	Density of large trees (>50 cm dbh)	5
		Presence of preferred habitat tree species expected to contain hollows (large trees >50 cm dbh)	5
Site context	Species mobility capacity	Size of habitat patch	10
	Absence of threats	Habitat clearing	15
		Wildfire damage	
		Feral animal predation and/or control	

Species Stocking Rate – Species Usage

Species usage criteria for greater glider (southern and central) is provided in **Table 5.12**. The species usage criteria was calculated based on the habitat mapping classification for the species, comprising emerging foraging and dispersal habitat, potential/future or likely/current denning habitat. In addition, potential/future denning habitat can be improved to 'high usage' with the installation of compensatory denning features such as nest boxes compliant with an approved OAMP.

Table 5.12 Species Usage Criteria for the greater glider (southern and central)

Parameter	Limited Usage to the Species		Moderate Usage	High Usage
Score	**2.5**	**5**	**10**	**15**
Criteria	Emerging foraging/ dispersal	The patch is mapped as foraging/ dispersal	The patch is mapped as potential/ future denning	The patch is mapped as likely/ current denning **OR** The patch is mapped as potential/ future denning and contains nestboxes compliant with a nestbox plan (density/ monitoring/ location)

Species Stocking Rate – Role and Importance of the Species Population on Site (SSR Supplementary Table)

Relevant to the greater glider (southern and central) and scored at a matter level, the scoring for the attribute Role and Importance of the Species Population on Site (SSR Supplementary Table), followed the below:

- Key source for population breeding: 10/10, conservation advice states all populations are important.
- Key source population for dispersal: 5/5, due to occurrence within mapped biodiversity corridor.
- Necessary for maintaining genetic diversity: 0/15, Conservation advice states 'coastal populations' as necessary for maintaining genetic diversity.
- Near the limit of the species range: 0/15, due to not occurring near the limit of the species range.

5.4.3.3 Yellow-bellied glider (South-Eastern)

Site Condition and Site Context

The yellow-bellied glider (south-eastern) shows a preference for large patches of mature old growth forest, particularly with winter-flowering and smooth-barked eucalypt species, that provide suitable foraging habitat and shelter (DAWE 2022e). As detailed in the subspecies' Conservation Advice (DAWE 2022e). Yellow-bellied glider (south-eastern) also require some level of floristic diversity to provide a year-round food supply, and they are unlikely to persist in forests dominated by only one or two tree species. A 2005 study by J. Eyre identified 13 sap tree species in southern Queensland including *Corymbia citriodora*, *Eucalyptus biturbinata*, *E. longirostrata*, *E. major*, *E. melliodora*, *E. moluccana*, *E. tereticornis*, *E. racemosa*, *E. resinifera*, *E. laevopinea*, *E. sphaerocarpa*, *C. intermedia* and *Angophora leiocarpa*. Therefore, the presence and species richness of these sap tree species within the ecologically dominant layer (usually the canopy) was measured to indicate the quality and availability of foraging habitat.

The sub-species relies on hollows for shelter and denning purposes during the day; suitable hollows are generally found in large living trees usually >1 m in diameter. Therefore, the density (per ha) of live hollow bearing trees with a minimum hollow size of 10 cm and the presence of smooth or half-bark trees with a DBH >50 cm was scored to calculate shelter and breeding habitat.

The sub-species' live in family groups of two to six individuals within exclusive home ranges of approximately 50–65 ha (plausible range of 25–85 ha) large enough to contain the large trees that provide suitable foraging and denning habitat features (DAWE 2022e). In addition, the gliding distance of the sub-species is dependent upon tree height with a maximum distance of 120–140 m reduced to an average gliding distance of 25.2 m within low-canopy forest (DAWE 2022e). Therefore, both the size of habitat patch and median canopy height relative to the benchmark for the RE were measured to indicate the quality of mobility habitat.

Table 5.13 presents the species-specific habitat quality attributes incorporating, floristic diversity, tree size, hollow bearing trees and patch size measured within the site condition and site context components of the MHQS.

Table 5.13 Yellow-bellied glider (south-eastern) Species-Specific Habitat Quality Attributes Calculated Towards the Site Condition and Site Context Component of the MHQS

MHQA Component	Sub-Attribute	Species-Specific Indicator	Maximum Score
Site condition	Quality and availability of food and foraging habitat	Floristic diversity in EDL	10
	Quality and availability of shelter	Density of live trees (i.e. stags excluded) bearing at least one hollow >10 cm in diameter	5
		Presence of large (> 50 cm dbh) smooth bark or half-bark eucalypt species likely to bear hollows in the immediate future	5
Site context	Species mobility capacity	Presence of tall trees/ median canopy height relative to RE benchmark	5
		Size of habitat patch (all utilisation types combined). Connecting patches are only considered if completely connected – i.e. no fragmentation.	5
	Absence of threats	Habitat clearing	15
		Wildfire damage	
		Feral animal predation and/or control	

Species Stocking Rate – Species Usage

Table 5.14 below presents the species usage criteria for the yellow-bellied glider (south-eastern) which was calculated based on the habitat mapping class – emerging foraging/dispersal, emerging breeding/denning, foraging and dispersal and breeding and denning. Foraging and dispersal habitat could be scored as 'moderate usage' if it was connected to breeding and denning habitat or elevated to 'high usage' with the installation of compensatory denning features such as nest boxes compliant with an approved OAMP.

Table 5.14 Species Usage Criteria for the yellow-bellied glider (south-eastern)

Parameter	Limited usage to the species		Moderate usage	High usage
Score	**2.5**	**5**	**10**	**15**
Criteria	Emerging foraging/ dispersal OR emerging breeding/ denning	The patch is mapped as foraging/ dispersal AND The patch is not connected to breeding/ refuge habitat	The patch is mapped as foraging/ dispersal AND The site is within 100 m to breeding and denning habitat	The patch is mapped as breeding and denning OR The patch is mapped as foraging/dispersal AND The patch is not connected to breeding/ refuge habitat but contains nestboxes compliant with a nestbox plan (density/ monitoring/ location)

Species Stocking Rate – Role and Importance of the Species Population on Site (SSR Supplementary Table)

Relevant to the yellow-bellied glider (south-eastern) and scored at a matter level for the entire assessment unit, the scoring for the attribute Role and Importance of the Species Population on Site (SSR Supplementary Table), followed the below:

- Key source for population breeding: 0/10, due to patchy distribution and inferred lower density.
- Key source population for dispersal: 5/5, due to occurrence within mapped biodiversity corridor.
- Necessary for maintaining genetic diversity: 0/15, due to patchy distribution and inferred lower density.
- Near the limit of the species range: 0/15, due to not occurring near the limit of the species range.

5.4.3.4 Koala

Site Condition and Context

Koala habitat suitability is based on the availability of the total set of attributes (i.e. presence of feed and shelter trees, connectivity, proximity to other populations) required by the species to meet its' survival and reproduction requirements (Department of Agriculture Water and the Environment 2022c). In consideration of this, koala habitat will often include:

- Forests or woodlands, especially with a higher proportion of feed tree species, and may include remnant or non-remnant vegetation.
- Roadside and railway vegetation and paddock trees.
- Safe intervening ground for travelling between trees and patches to forage, shelter and reproduce.
- Access to vegetated corridors or paddock trees to facilitates movement between patches.

The presence of preferred food tree species including, species richness and/or proportion of the canopy cover of locally important koala food trees was measured in conjunction with the size of habitat patch relative to the expected foraging range of the species to determine the quality of foraging habitat. Crucial habitat elements include patches and movement corridors such as drainage lines, riparian zone and patches that are resilient to drying conditions (Department of Agriculture Water and the Environment, 2022). These corridors facilitate gene flow, climate refugia, movement across the landscape, shelter habitat and protection from predation (Department of Agriculture Water and the Environment, 2022). In addition, large trees are considered to provide refuge habitat due to the microclimate thermoregulation of an increased canopy cover and exposure to wind (Department of Agriculture Water and the Environment, 2022). Therefore, the presence and proximity of landscape features to each habitat patch was measured along with the density of large, shelter trees to indicate the quality of shelter habitat. Finally, mobility habitat quality was scored according to each the patch size relative to the requirements of the species ranging from 1 ha to >1000 ha and the presence or proximity of vegetated watercourses to each habitat patch. **Table 5.15** presents the species-specific habitat quality attributes incorporating food and shelter tree presence, patch size and proximity to refuge as measured within the site condition and site context sub-attributes of the MHQA.

Table 5.15 Koala Species-Specific Habitat Quality Attributes Calculated Towards the Site Condition and Site Context Component of the MHQA

MHQA Component	Sub-Attribute	Species-Specific Indicator	Maximum Score
Site condition	Quality and availability of food and foraging habitat	Presence of preferred food tree species	5
		Size of habitat patch	5
	Quality and availability of shelter	Density of shelter trees i.e. large trees (as per benchmark)	5
		Presence of refugia (e.g., drainage lines, riparian zones, patches with favourable hydrological systems)	5
Site context	Species mobility capacity	Size of habitat patch	7.5
		Presence of nearby vegetated watercourses	2.5
	Absence of threats	Habitat clearing	15
		Wildfire damage	
		Feral animal predation and/or control	

Species Stocking Rate – Species Usage

Table 5.16 below presents the species usage criteria for koala which was calculated based on the habitat mapping class – breeding, foraging and dispersal or climate refugia, vegetation condition and proximity of the patch to refuge areas like drainage lines.

Table 5.16 Species Usage Criteria for the koala

Parameter	Limited usage to the species		Moderate usage	High usage
Score	**2.5**	**5**	**10**	**15**
Criteria	Emerging breeding, foraging and dispersal	The site is within a patch mapped as breeding/ foraging/ dispersal habitat AND Patch does not contain OR is not connected to refugia (within 500 m to the site) AND Mapped as cleared land	The patch is mapped as breeding/ foraging/ dispersal habitat AND Patch does not contain or is not connected to refugia (within 500 m to the site) AND Mapped as remnant or regrowth OR The patch is mapped as breeding/foraging, dispersal habitat AND The site is within vegetation mapped as cleared land AND The patch contains refugia (within 500 m to the site)	The patch is mapped as climate refugia OR The patch is mapped as breeding/ foraging/ dispersal **AND** The site is within vegetation mapped as regrowth or remnant AND The patch is connected to refugia (within 500 m to the site)

Species Stocking Rate – Role and Importance of the Species Population on Site (SSR Supplementary Table)

Relevant to the koala and scored at a matter level for the entire assessment unit, the scoring for the attribute Role and Importance of the Species Population on Site (SSR Supplementary Table), followed the below:

- Key source for population breeding: 10/10,included within the genetically important populations north of the Clarence River Valley, New South Wales (DAWE, 2022).
- Key source population for dispersal: 5/5, due to occurrence within mapped biodiversity corridor.
- Necessary for maintaining genetic diversity: 5/15, due to low density of the population and therefore inferred low genetic diversity.
- Near the limit of the species range: 0/15, due to not occurring near the limit of the species range.

5.4.3.5 Collared Delma

Site Condition and Context

The Approved Conservation Advice for *Delma torquata* (Department of the Environment Water Heritage and the Arts 2008d) provides detail on specific habitat requirements for collared delma as: 'Eucalypt dominated woodland to open forest where it is associated with suitable microhabitats (exposed rocky outcrops) where ground cover is predominantly native grasses and forbs, such as *Themeda triandra*, *Cymbopogon refractus*, Aristida sp. and Lomandra sp. (Peck & Hobson, 2007). The species is also known from two locations featuring woodlands of *Eucalyptus tereticornis* or *Acacia harpophylla* where significant rock components were absent (Steve K Wilson 2015).

As per SPRAT, the presence of rocks, logs, bark and other coarse woody debris, and mats of leaf litter (typically 30–100 mm thick) appears to be an essential characteristic of the microhabitat and is always present where the species occurs (Brigalow Belt Reptiles Workshop 2010). Therefore, the habitat quality attributes shown in **Table 5.17** were designed to measure the abundance of prey microhabitat, surface rocks, leaf litter and coarse woody debris and incorporated into the site condition component of the MHQA. As the species is sedentary, the species mobility capacity is not measured for the collared delma.

Table 5.17 Collared delma Species-Specific Habitat Quality Attributes Calculated Towards the Site Condition Component of the MHQA

MHQA Component	Sub-Attribute	Species-Specific Indicator	Maximum Score
Site condition	Quality and availability of food and foraging	Abundance of suitable microhabitat for prey species	10
	Quality and availability of shelter	Surface rocks and/or rock outcrops	4
		Mats of leaf litter (30–100 mm)	3
		Coarse woody debris	3
Site context	Species mobility capacity	N/A – (species is sedentary and is known to utilise the same individual rock)	N/A
	Absence of threats	Habitat clearing	15
		Wildfire damage	

Species Stocking Rate – Species Usage

The collared delma is mapped as having a single habitat type and therefore was assigned the maximum species usage score.

Species Stocking Rate – Role and Importance of the Species Population on Site (SSR Supplementary Table)

Relevant to the collared delma and scored at a matter level for the entire assessment unit, the scoring for the attribute Role and Importance of the Species Population on Site (SSR Supplementary Table), followed the below:

- Key source for population breeding: 10/10, if present, northern population may be more resilient to future warming temperatures.
- Key source population for dispersal: 5/5, due to occurrence within mapped biodiversity corridor.
- Necessary for maintaining genetic diversity: 15/15, all populations are considered necessary.
- Near the limit of the species range: 15/15, impact and offset areas occurring near the northern limit of recorded species range.

6.0 Offset Property Values

A summary of available MNES habitat, as well as the broader ecological values for each of the five properties is provided below.

All of the potential offset properties contain cleared areas and vegetation in remnant and regrowth condition, commensurate with that found within the Disturbance Footprint. The dominant regrowth and remnant vegetation communities are eucalypt woodland and forest, including on lower colluvial slopes. Vine thicket communities are also scattered throughout, often centred around drainage lines. Within the available land of the proposed offset properties, mapped habitat provides suitable habitat for the impacted MNES species, with confirmed records of impacted MNES either within or adjacent to the potential offset property. **Section 6.1** provides an overview of R1 and R2, where desktop and field surveys have been undertaken, but additional field survey is yet to be completed. **Section 6.2** provides an overview of F1, F2 and F3, where all comprehensive field surveys have been completed.

6.1 Offset Properties R1 and R2

Mapped habitat for proposed offsets R1 and R2 known at the matter level, with habitat mapping and vegetation assessment only partially available. Targeted field surveys have been completed on both properties, and the suitability of habitat is presented with a high degree of confidence (refer **Table 6.1**).

Table 6.1 Suitable Habitat within Potential Offset Properties

Target Species	Total Area (ha) of Potential Habitat		Total (ha)
	Property R1	Property R2	
Cycas megacarpa	61.2	1,264.2	1,325.4
Northern quoll (*Dasyurus hallucatus*)	22.6	60.8	83.4
Greater glider (southern and central) (*Petauroides volans*)	53.3	2,175.4	2,228.7
Yellow-bellied glider (south-eastern) (*Petaurus australis australis*)	45.1	1,541.6	1,586.7
Koala (*Phascolarctos cinereus*)	53.3	2,175.4	2,228.7
Collared delma (*Delma torquata*)	30.0	2140.3	2,170.3

6.1.1 Property R1

Property R1 was assessed via desktop assessment and field survey. The property can be characterised as an active grazing property, comprising steep to undulating hills and ranges, with variation noted in habitat condition, comprising both remnant and cleared land types.

Habitat Values and Overlap with MNES

The proposed offset property is mapped as supporting three broad habitat types comprising:

- Mixed eucalypt woodland on steep slopes.
- Semi evergreen vine thicket.
- Cleared land.

Field habitat assessments validated suitability for all impacted MNES, including *Cycas megacarpa* and all threatened fauna. The area of available habitat was limited, however larger habitat patches that provide connection to protected area estates are present. *Cycas megacarpa* was recorded in particular abundance, and is considered connected to the impacted population.

Landscape Connectivity

The property intersects mapped biodiversity corridors, including areas of state and regional biodiversity significance. Habitat corridors are contiguous with protected areas including State Forest. Habitat connectivity extends to species records (known and historical) of greater glider (southern and central), yellow-bellied glider (south-eastern), northern quoll and collared delma.

Active Threats

The property was noted as supporting large patches of the unmanaged weed, *Lantana camara* (lantana), presenting an active threat to ecological values, including the impacted MNES. This invasive species was largely concentrated on steep hillsides and near waterways. Other noted threats to MNES habitat included:

- Feral animals including habitat decline from cattle grazing.
- Potential habitat clearing (unregulated vegetation) – concentrated in lower lying parts of the landscape.
- Erosion and sedimentation – prevalent on drainage lines and waterways, particular in more lowing lying parts of the landscape.
- Inappropriate fire management or unmanaged wildfire risk – particularly on the very steep slopes, with limited access. Roads to manage risk were no longer useable or barricaded by dense weeds (*Lantana camara*).

6.1.2 Property R2

Property R2 was assessed via desktop assessment and field survey, including vegetation assessments and targeted fauna surveys. Detailed habitat mapping or habitat quality assessments were not completed. The property can be characterised as an active grazing property containing a mix of landforms, including steep hills or ranges and lower undulating hills. Vegetation coverage contains a combination or remnant and regrowth, as well as areas of cleared land.

Habitat Values and Overlap with MNES

The proposed offset property is mapped as supporting four broad habitat types comprising:

- *Eucalyptus crebra* woodland.
- Mixed eucalypt woodland on steep slopes.
- Semi evergreen vine thicket.
- Cleared land.

Targeted fauna surveys confirmed the presence of greater glider (southern and central) within *Eucalyptus moluccana* woodland, contiguous with other woodland types including mixed eucalypt woodland on steep slopes. Known locations of *Cycas megacarpa* were recorded on the property, mostly as scattered individuals, however some hill slopes were noted as supporting higher densities. Field surveys also confirmed habitat suitable for koala, yellow-bellied glider (south-eastern), northern quoll and collared delma. Confirmed habitat includes breeding, foraging and dispersal habitat types.

Landscape Connectivity

The property includes a number of watercourses, many associated with analogous threatened fauna habitat types. Habitat corridors intersect the property, comprising areas mapped as having state and regional significance. Habitat corridors are contiguous with expanses of vegetation, providing connectivity into protected areas, such as State Forest.

Active Threats

The property is generally well managed, with the scope and severity of threats increasing in parts less frequently used for cattle grazing. Active threats recorded on the property included:

- Invasive weeds, particularly *Lantana camara*, concentrated on waterways and unmanaged slopes.
- Feral animals including habitat decline from cattle grazing. Of particularly note was the relevant abundance of predatory fauna such as dingo and cats. Dingo were noted to be in high numbers during the field survey.
- Potential habitat clearing (unregulated vegetation) – largely cleared and regularly managed. Some pockets of unregulated vegetation comprising suitable habitat (including emergent habitat are noted).
- Inappropriate fire management or unmanaged wildfire risk – particularly on the very steep slopes, with limited access. Roads to manage risk within more remote areas of the property were no longer useable.

6.2 Offset Properties F1, F2 and F3

Mapped habitat for proposed offsets F1, F2 and F3 is available at the matter unit and assessment unit level, supported by robust habitat mapping and vegetation assessment. Targeted field surveys have been completed on all properties, including habitat quality assessment, and the suitability of habitat is presented with a very high degree of confidence (refer **Table 6.2**).

Table 6.2 Suitable Habitat within Potential Offset Properties

Target Species	Justification	Total Area (ha) of Potential Habitat			Total (ha)
		Property F1	Property F2	Property F3	
Cycas megacarpa	Mapped habitat	4,556.9	6,512.5	2,094.4	13,163.8
Northern quoll (*Dasyurus hallucatus*)	Denning and refuge	807.6	1,295.5	277.4	2,380.5
Greater glider (southern and central) (*Petauroides volans*)	Likely/current denning	1,101.0	545.6	1,483.2	3,129.8
	Potential future / denning	2,150.2	3,275.0	483.8	5,909.0
	Foraging and dispersal	1,061.7	2,654.9	2,276.8	5,993.4
Yellow-bellied glider (south-eastern) (*Petaurus australis australis*)	Breeding and denning	583.2	730.1	1,676.9	2,990.2
	Foraging and dispersal	783.0	3,622.2	1500.8	5,906.0
Koala (*Phascolarctos cinereus*)	Climate refugia	92.4	206.9	42.0	341.3
	Breeding, foraging and dispersal	4,658.3	7,644.0	4,231.3	16,533.6
Collared delma (*Delma torquata*)	Breeding and foraging	1,617.4	836.6 ha	2,015.4	3,632.8

6.2.1 Property F1

Property F1 was assessed as part of baseline and targeted field surveys. Detailed ecological surveys which sought to map and validate assessment units, as well as assess the corresponding habitat quality scores was completed in 2023. Vegetation and habitat across this property contains a mix of remnant, regrowth and cleared land found on undulating hills and ranges.

Habitat Values and Overlap with MNES

The proposed offset property was confirmed as supporting suitable habitat for impacted MNES, covering six broad terrestrial habitat types:

- *Eucalyptus crebra* woodland.
- *Eucalyptus moluccana* woodland.
- Mixed eucalypt woodland on steep slopes.
- Riparian melaleuca woodland.
- Semi evergreen vine thicket.
- Cleared land.

Known locations of *Cycas megacarpa* were recorded throughout the property, mostly as scattered individuals or as being in low density. Several steep hill slopes were noted as supporting higher densities. Anecdotal evidence of northern quoll was provided by a third party. This is consistent with expectations, given large areas of denning and refuge habitat, as well as connectivity to other records in the region. Habitat mapping conducted for the property confirmed all impacted threatened fauna species. Of note is the expanse of koala breeding, foraging and dispersal habitat and northern quoll denning and refuge habitat. The property supports higher order waterways, enhancing the broader habitat value for MNES within the property.

Landscape Connectivity

The property includes a number of watercourses, including two higher order watercourses. Habitat corridors intersect the property, comprising areas mapped as having state significance. Mapped MNES habitat areas are contiguous with landscape corridors and emerging regrowth areas provide further opportunity to enhance fauna movement.

Active Threats

The property is generally well managed, however the scope and severity of threats does vary across the property, seemingly linked to grazing pressure and areas of active regrowth management. Active threats include:

- Invasive weeds, particularly *Lantana camara* and *Cryptostegia grandiflora* (rubber vine) concentrated on waterways. Waterways are mapped as habitat for the impacted threatened fauna species.
- Introduced animals including habitat decline from cattle grazing. The topography of the property lends itself to higher concentrations of cattle on ridges and higher elevation paddocks, where water infrastructure is in place. Woodlands are typically open in these areas, subjected to historical clearing / thinning impacts.
- Potential habitat clearing (unregulated vegetation) – the offset property is largely unregulated vegetation, yet supports expanses of remnant and advanced regrowth habitat suitable for MNES. The potential that ridgelines and higher elevation paddocks are re-opened to accommodate grazing is an active threat to MNES.
- Inappropriate fire management or unmanaged wildfire risk – particularly on the very steep slopes, with limited access. For much of the offset property, emergency access is typically well maintained through existing farm tracks. However large portions of the property are currently inaccessible due an absence of track maintenance.

6.2.2 Property F2

Property F2 was assessed using a range of methods and comprised baseline and targeted field surveys, including seasonal surveys. Detailed ecological surveys which sought to map and validate assessment units, as well as assess the corresponding habitat quality scores was completed between 2022 and 2023. Offset property F2 contains a mix of landforms, including steep hills or ranges, undulating hills and alluvial flats. Vegetation coverage contains a combination or remnant, regrowth and cleared land.

Habitat Values and Overlap with MNES

The proposed offset property was confirmed as supporting suitable habitat for impacted MNES, covering seven broad habitat types:

- Alluvial eucalypt woodland.
- Eucalyptus crebra woodland.
- Eucalyptus moluccana woodland.
- Mixed eucalypt woodland on steep slopes.
- Riparian melaleuca woodland.
- Semi evergreen vine thicket.
- Cleared land vegetation.

The offset property is known to support varying densities of *Cycas megacarpa* including high densities. Northern quoll has also been confirmed from habitat corridors which intersect the property. Habitat mapping conducted for the property confirmed assessment units relevant to all impacted MNES. Of note is large expanses of koala breeding, foraging and dispersal habitat, northern quoll denning and refuge and greater glider (southern and central) denning and foraging habitat types.

Landscape Connectivity

The property includes several watercourses, mostly lower order streams. State significant habitat corridors intersect the property, comprising large expanses of remnant and regrowth vegetation, mapped as suitable habitat for MNES. Habitat corridors are contiguous with expanses of vegetation further afield, including protected estate.

Active Threats

Several active threats of varying scope and severity are known to the property, including.

- Invasive weeds, particularly *Parthenium hysterophorus* (parthenium)*, Lantana camara* and *Cryptostegia grandiflora* concentrated near waterways, however dense patches of *Lantana camara* are also known to hillslopes.
- Introduced animals including habitat decline from cattle grazing. Populations of predatory fauna such as dingo are well established, particularly within larger expanses of remnant vegetation, within recognised landscape corridors. Cattle grazing impacts tend to be concentrated near water infrastructure and cleared paddocks.
- Habitat clearing (unregulated vegetation and select clearing) – the offset property comprises large areas of unregulated vegetation which supports confirmed habitat for MNES. Active management advanced regrowth has been confirmed as part of field surveys. Selective clearing of mature Eucalypt trees, likely recognised forage trees or shelter trees for the impacted MNES species, was also identified.
- Erosion and sedimentation is noted throughout the property, concentrated on hillslopes that have recently undergone clearing (regrowth) or on hillside access tracks that comprise volcanic soil types.

- Inappropriate fire management or unmanaged wildfire risk – particularly on the very steep slopes, with limited access. Emergency access is limited, with many tracks no longer in operation due to erosion, or presence of obstructions (fallen trees).

6.2.3 Property F3

Property F3 was assessed as part of baseline and targeted field surveys, including seasonal surveys. Detailed ecological surveys which sought to map and validate assessment units, as well as assess the corresponding habitat quality scores was completed between 2021 and 2023. Offset property F3 contains a mix of landforms, including steep hills or ranges, undulating hills and alluvial flats. The property can be characterised as a grazing property containing a mix of landforms, including steep hills or ranges and undulating hills. Vegetation coverage contains a combination or remnant, regrowth and cleared land.

Habitat Values and Overlap with MNES

The proposed offset property was confirmed as supporting suitable habitat for impacted MNES, covering four broad habitat types:

- Eucalyptus *moluccana* woodland.
- Mixed eucalypt woodland on steep slopes.
- Semi evergreen vine thicket.
- Cleared land.

Targeted surveys of the property have confirmed occurrences of koala, as well as MNES glider species (yellow-bellied glider (south-eastern) and greater glider (southern and central)). Habitat mapping conducted for the property has also confirmed assessment units relevant to all impacted MNES. Of note is large expanses of koala breeding, foraging and dispersal habitat including emerging habitat which provide opportunity for landscape connectivity improvements if managed over time. The offset property supports low to moderate densities of *Cycas megacarpa*, however the extent of the species is limited to a few locations.

Landscape Connectivity

The property includes a number of watercourses, mostly lower order streams. State significant habitat corridors intersect the property, although typically concentrated near the more remote corners of the offset property. Mapped MNES habitat areas are contiguous with landscape corridors and emerging regrowth areas provide further opportunity to enhance fauna movement.

Active Threats

The property is an active grazing property, with noted recent management of regrowth to facilitate additional grazing areas suitable for agistment. The property neighbours protected estate and other freehold land parcels. As a result, the scope and severity of threats vary across the property.

Active threats include:

- Invasive weeds, particularly *Lantana camara* concentrated near waterways and hillslopes.
- Introduced animals including habitat decline from cattle grazing. Populations of predatory fauna such as dingo are well established, particularly within larger expanses of remnant vegetation, within recognised landscape corridors. Other notable threats associated with introduced animals include habitat degradation from wild horse populations and feral pig.
- Habitat clearing (unregulated vegetation) – the offset property comprises large areas of unregulated vegetation which supports confirmed habitat for MNES. Active management advanced regrowth has been confirmed as part of field surveys.
- Inappropriate fire management or unmanaged wildfire risk – particularly on the very steep slopes, with limited access. The risk posed from adjacent properties, where fire management protocols vary will require management.

7.0 Offset Suitability and Delivery

7.1 Overview

This offset strategy provides an overview of likely offset scenarios for relevant MNES. This is based on anticipated values for impact areas, habitat quality, and offset assessment guide inputs and will be finalised through field surveys and the development of the OAMP.

Commonwealth government policy allows for a range of options for offset delivery, however, 90% must be delivered via direct, land-based driven approaches. Accordingly, the delivery approach for this Project is primarily a proponent driven land-based solution, accounting for a minimum of 90% of the offset requirement. The offset scenarios and examples provided below achieve 100% of the offset requirement in order to demonstrate that offsets are achievable, regardless of any final indirect offset percentage (e.g. 10% or less). Preliminary assessments across five potential properties have been undertaken to identify for the suitability of meeting offset requirements for this project. Although yet to be finalised the offset may be composed of a single individual property or a blend of elements from all properties having the potential to meet the offset obligations. The final composition or make up of the offset is subject to additional field assessments to inform on specific suitability of vegetation or habitat.

Neoen is committed to reducing potential impacts on biodiversity values, particularly those comprising MNES, through avoidance and mitigation measures with offsets employed as a final measure to ameliorate significant residual impacts. The delivery of offsets would be conducted in accordance with Project approval conditions, which are further considered below:

- Prior to commencement, an OAMP will be developed and provided to the Commonwealth for approval. This plan will:
    - Be prepared by a suitably qualified person.
    - Only be implemented following approval of the OAMP, and commence simultaneously or before the commencement of the Project.
    - Be implemented for the duration of the Project.

7.2 Legal Mechanism

The offset area(s) will be legally secured in perpetuity in accordance with the *EPBC Act Environmental Offsets Policy* (DSEWPaC 2012). Legal mechanisms of securing the offset include:

- Conservation agreements under the EPBC Act.
- A voluntary declaration under the VM Act.
- A protected area (including a nature refuge) under the NC Act.
- Another mechanism specified under the regulation, (including a statutory covenant) under the *Land Act 1994* or *Land Title Act 1994.*

Of the above mechanisms, the voluntary declaration process under the VM Act is the Projects preferred and anticipated method for legal securement. A voluntary declaration provides for timely security of the offset area through an established process. It protects vegetation from broadscale land clearing by legally securing the area, designating it as a Category A regulated area on a Property Map of Assessment Vegetation. A request for a declaration must be accompanied by a management plan (offset area management plan in this case) that outlines the activities required to achieve the management intent and outcomes. Once a declaration is made, it is registered in title and is binding on all current and future owners of the land until the intent and outcomes of the management plan have been achieved (Department of Natural Resources, Mines and Energy, 2019).

It is noted that the final mechanism to be implemented will be determined as part of the OAMP and will be determined following finalisation of the Project design, as well as part of ongoing consultation within the DCCEEW and relevant landholders.

The OAMP will be approved prior to commencement of the action and Neoen will legally hold the nominated offset areas (through ownership or agreement). This provides certainty for the offset area in the short-term and allows for active management of the offset area to commence upon approval of the OAMP. The formal, legally securing mechanism is an administrative step that provides for permanent, secure, and long-term protection for the offset area. An application for legal securement of the offset will be submitted to the relevant Queensland government department within 6 months of commencement of the action, and the offset secured for the duration of the approval. The approved OAMP will be attached to the legal mechanism used to legally secure the offset areas. DCCEEW will be notified within five business days of the legal security mechanism for each offset area being executed.

7.3 Offset Suitability for MNES

The following sections present the overall vegetation condition of the proposed offset areas to demonstrate overall suitability for improvements as well as the suitability, quality, conservation gain opportunities, and existing threats for each species. The OAG was used to calculate the offset requirements for the Project and determine whether the potential offset properties are able to acquit the offset liability for each species. For each significantly impacted MNES, the inputs for the OAG calculator, including justifications for the adopted values, are provided in sections below. Results from the OAG calculator for each species are displayed in **Appendix B**. The final offset area requirements will be determined following finalisation of Project disturbance footprint and delineation of the final offset area or areas. Updated OAG inputs will be detailed and justified within in the OAMP and will reflect the site-specific particulars of the offset areas and confirm the approach to offset delivery.

7.3.1 Vegetation Condition Attributes

Vegetation condition contributes towards the site condition for all MNES, as per the MHQA, and provide an overview of key condition improvements. The vegetation condition sub-attributes include the structural and compositional measurables derived from the habitat quality assessment. For threatened fauna, these sub-attributes contributed a maximum score of 80 towards site condition (total site condition score is out of 100) whereas for threatened flora, they represent the maximum score obtainable (maximum score of 80).

Table 7.1 provides a summary of the vegetation sub-attribute scores averaged across all habitat quality assessment sites, categorised by condition state including cleared land, regrowth and remnant. There is clear opportunity for improvement in all condition states and the results reflect the historic land use and management. This includes clearing, which has reduced canopy cover in cleared land areas, selective clearing resulting in the reduced number of large trees, grazing resulting in reduced ground cover species richness and shrub cover, and ineffective weed control resulting in the proliferation of weeds.

Vegetation in remnant condition scored the highest at an average of 54.6/80, followed by regrowth at 49.7/80 then cleared land areas at 46.0/80. The variance was lower than expected with remnant vegetation scoring lower than anticipated and conversely, highly degraded areas scored higher than predicted. However, there are key differences in the make-up of these scores:

- Remnant areas scored only moderately (8 out of 15) for large trees; however, these areas scored substantially higher than regrowth and cleared land areas indicating opportunity for conservation gain within this attribute across all offset areas regardless of vegetation condition state.
- Predictably, canopy cover scored substantially higher in both regrowth and remnant areas than highly degraded areas.
- Coarse woody debris scored moderately (3.3 out of 5) in cleared land areas; however, these areas scored substantially higher than regrowth areas and somewhat higher than remnant areas.
- Increased tree canopy height, organic litter cover and species richness of forbs and grasses as vegetation develops towards a remnant condition.
- Some attributes scored higher within highly degraded or regrowth vegetation than remnant, notably tree species richness, non-native plant cover and native perennial grass cover.

The results suggest some historical and/or ongoing degradation within the remnant sites as several attributes including large native trees (8.3/15), shrub layer cover (3.1/5) and coarse woody debris (2.2/5) scored on average, low to moderate throughout all sites.

In summary, the overall vegetation condition was moderate relative to the corresponding benchmark with cleared land and regrowth conditions scored higher than expected and remnant condition lower than expected. This supports the inclusion of a mix of conditions states in the offset areas as improvements in all states are available and achievable. The scoring demonstrates that the offset areas provide a strong base to improve upon, with potential to achieve HQS increase across all condition states.

Table 7.1 Summary of the Results of the Vegetation Condition Sub-Attributes within each Condition Class

Vegetation Sub-Attribute	Maximum Score	Average Score per Vegetation Condition		
		Cleared Land	Regrowth	Remnant
Number of large native trees	15	5.8	5.4	8.3
Tree canopy height	5	3.3	3.2	3.9
Recruitment of woody perennial species (in EDL) (%)	5	4.6	4.6	4.1
Tree canopy cover	5	2.4	4.5	4.2

Vegetation Sub-Attribute	Maximum Score	Average Score per Vegetation Condition		
		Cleared Land	Regrowth	Remnant
Native shrub layer cover (%)	5	2.5	3.7	3.1
Coarse woody debris	5	3.3	1.3	2.2
Native tree species richness	5	4.6	3.6	4.3
Native shrub species richness	5	3.0	4.4	4.3
Native grass species richness	5	2.7	2.7	3.4
Native forbs/other species richness	5	1.3	2.2	2.7
Non-native plant cover (%)	10	6.1	8.7	7.1
Native perennial grass cover (%)	5	3.5	1.8	2.4
Organic litter cover (%)	5	3.0	3.7	4.7
Total	**80**	**46.0 (57.5% of maximum score)**	**49.7 (62% of maximum score)**	**54.6 (68% of maximum score)**

7.3.2 Cycas megacarpa

7.3.2.1 Species Presence and Habitat Availability

The proposed offset areas are known to support *Cycas megacarpa* and its habitat. As shown in **Table 7.2** below, *Cycas megacarpa* was recorded across all proposed offset properties. Density information collected within properties F1, F2 and F3 has informed stocking rate calculations.

Table 7.2 *Cycas megacarpa* Presence and Habitat Availability

Attribute	Justification or Type	Offset Property				
		R1	R2	F1	F2	F3
Presence (record)	Known record, including desktop records	Yes	Yes	Yes	Yes	Yes
Contiguous with record(s)	Mapped corridors or contiguous habitat with species records	Yes	Yes	Yes	Yes	Yes
Habitat	Habitat not delineated –rapid and baseline field survey, in conjunction with desk based extrapolation of state habitat mapping layers only.	61.2	1,264.2	N/A	N/a	N/a
Habitat Type	Mapped habitat	Known	Known	4,556.9	6,512.5	2,094.4

7.3.2.2 Habitat Quality Assessment

Cycas megacarpa habitat was mapped as a single MU that was area-weighted according to the density classes output from the cycad interpolation and vegetation condition status as verified during field surveys. The area-weighted HQS, including the summary of site condition, site context and species stocking rate scores are presented in **Table 7.3** below.

Table 7.3 *Cycas megacarpa* Habitat Quality Assessment

Species	Matter Unit/ Habitat Utilisation	Impact				Offset			
		Cnd	Cxt	SSR	HQS	Cnd	Cxt	SSR	HQS
Maximum score		**3**	**3**	**4**	**10**	**3**	**3**	**4**	**10**
Cycas megacarpa	Habitat	1.9	2.3	3.2	**7.5***	1.9	2.4	3.2	**7.6***

**Denotes round up difference.*

Thorough *Cycas megacarpa* field surveys were conducted throughout the impact and offset areas with individuals recorded throughout a range of vegetation types, condition states and terrain. The resulting distribution records included presence/ absence and individual counts were interpolated throughout the Study Area to produce a distribution and density model. The modified habitat quality attributes used to calculate *Cycas megacarpa* habitat quality included the vegetation site condition attributes, site context, species stocking rate.

7.3.2.3 Conservation Gain

The proposed offset areas provide opportunities for conservation gain described in the Offset Policy, in particular 'improving existing habitat for the protected matter'. The site condition sub-attributes were analysed and presented in **Table 7.4** per cleared land, regrowth and remnant condition class to identify the potential conservation gain that could be achieved as the vegetation matures from cleared land and regrowth toward remnant status. This demonstrates a potential HQS improvement, particularly in habitat areas comprising cleared land and regrowth vegetation communities.

Table 7.4 Summary of the Results of the Site Condition Attributes within Mapped *Cycas megacarpa* Habitat of the Offset Areas Only

Site Condition	Max score (weighted max score)	Average score per vegetation condition within mapped habitat		
		Cleared land	Regrowth	Remnant
Number of large native trees	15 (0.6)	5.8	5.8	8.3
Tree canopy height	5 (0.2)	3.3	3.3	3.9
Recruitment of woody perennial species (in EDL) (%)	5 (0.2)	4.6	4.3	4.1
Tree canopy cover	5 (0.2)	2.4	3.9	4.2
Native shrub layer cover (%)	5 (0.2)	2.5	2.4	3.1
Coarse woody debris	5 (0.2)	3.3	2.5	2.2
Native tree species richness	5 (0.2)	4.6	4.6	4.3
Native shrub species richness	5 (0.2)	3.0	3.9	4.3
Native grass species richness	5 (0.2)	2.7	3.0	3.4
Native forbs/other species richness	5 (0.2)	1.3	1.9	2.7
Non-native plant cover (%)	10 (0.4)	6.1	7.5	7.1
Native perennial grass cover (%)	5 (0.2)	3.5	3.6	2.4
Organic litter cover (%)	5 (0.2)	3.0	4.4	4.7
Total	**80 (3)**	**52.9**	**58.6**	**63.9**
Average site condition score		**1.6**	**1.8**	**2.0**

Species Stocking Rate

A summary of species stocking rate scoring is provided within **Table 7.5**. These attributes were scored based on the results of the targeted field survey records and subsequent *Cycas megacarpa* interpolation model. A detailed account of species stocking rate for *Cycas megacarpa* is provided in **Section 5.4.2.2**.

Table 7.5 identifies the offsets properties as having limited scope for improvement to most components of stocking rate, noting the established population on all properties. However, the scores demonstrate an opportunity for improvements in density.

Table 7.5 Summary of the Results of the Species Stocking Rate Sub-Attributes within the Offset Areas

SSR Attribute	Details/ Sub-Attribute	Cm		
		Score	Max	Diff
Presence detected on or adjacent to site (neighbouring property with connecting habitat)	Detection with offset area or impact area.	10	10	0
Number of plants on site	As estimated using known records and spatial interpolation tools	30	30	0
Extent of population on site (ha)	As demonstrated with spatial interpolation analysis, as well as known extents derived from field survey.	30	30	0
Approximate density (per ha) over suitable habitat within project area	Calculated from the mapping extent divided by number of estimated plants.	5	20	15
Role/ importance of species population on site	Key source population for germination and seed/gamete dispersal	10	10	0
	Necessary for maintaining genetic diversity	15	15	0
	Near the limit of the species' range	0	15	15

7.3.2.4 Threats

A summary of the area-weighted scores for the wildfire and habitat clearing threats is presented in **Table 7.6** showing that both threats scored moderately at 8.5 and 8.8 respectively.

Table 7.6 Area-Weighted Scores for Wildfire and Habitat Clearing Threats

Threat	*C.megacarpa*		
	Avg.	Max	Diff
Wildfire	8.5	15	**6.5**
Habitat clearing	8.8	15	**6.2**

Threat management actions will need to be directed to both threats to ensure a measurable improvement of the threat and subsequent HQS. As such, an integrated offset management approach will result in the greatest improvement to habitat quality.

- **Habitat Clearing**: calculated at a monitoring site level, with threats immediately possible through legal securement as Category A restricted vegetation under the VM Act. Offset area management plans will prevent the ongoing impact of selective logging and regrowth management. Across the offset areas, gradual habitat clearing has comprised over 782.9 ha within a two year period. This is largely due to the ongoing nature of small clearing events and the unrestricted nature of vegetation (Category X designation).

- **Wildfire Damage**: Cycads are resilient and dependent upon all but catastrophic wildfire disturbance events. Therefore, re-establishing fire regimes consistent with vegetation community guidelines will maintain the appropriate disturbance cycle suitable for the species whilst maintaining a juvenile survival rate high enough to maintain the viability of the population.

Associated Management Actions

Indicative management actions for the proposed offset area to counteract existing threats are listed below:

- In-perpetuity protection within offset area – legally secured.
    - This elevates the regulatory status of an area to a MSES thus increasing the legal protection of the species' habitat. Moreover, unregulated vegetation clearing within areas mapped as cleared land/ Category X will no longer be permitted allowing the vegetation within these sites to regenerate and provide the structural and compositional values measured within the site condition attributes.
- Species-appropriate bushfire management plan implemented.
    - Both reduces the risk of wildfire-induced habitat degradation by the construction and maintenance of suitable firebreaks/ emergency access and fuel-reduction burns. Moreover, the implementation of fire regimes consistent with relevant vegetation community guidelines will maintain suitable microhabitat features characteristic of each vegetation community. For example, prevent the formation of a dense understorey to potentially smother *Cycas megacarpa* individuals and prevent or reduce the likelihood of insect pollination.
- Targeted pest and weed control implemented.
    - Feral pigs can cause damage to individual *Cycas megacarpa* by uprooting emerging juveniles however, this is not recognised has a substantial threat to the species or offset population but should be monitored.
- Improvement to vegetation condition – enhanced foraging, shelter and breeding habitat.
    - Cattle grazing is the dominant land-use of the study area and is continuing to degrade the native vegetation condition and/or inhibit the regeneration capacity of already highly degraded areas. Therefore, implementing strategies to limit grazing pressure throughout various areas will see an improvement of the vegetation condition reflected within the site condition attributes.
- Enhanced landscape connectivity – prioritisation of regrowth woodlands and emerging habitat areas for offset areas.
    - Improves the carrying capacity of both the highly degraded areas which currently provide limited habitat and improves the value of current habitat by increasing foraging, breeding and/ or dispersal resources.

7.3.2.5 Offset Assessment Guide Calculations

The offset assessment guide inputs relevant to *Cycas megacarpa* are provided in **Table 7.7**.

Table 7.7 OAG Inputs for *Cycas megacarpa*

Parameter	Input	Justification
EPBC Act Status	Endangered	Effective date 16 July 2000
Annual probability of extinction	1.2%	As per OAG
Impact Calculator		
Area of habitat	641.5 ha	As detailed in Attachment B4 (Assessment of Matters of National Environmental Significance).
Quality	8	Recorded across 24 habitat quality site assessments and completed in accordance with the methodology described in this Offset Management Strategy. The methodology incorporates site condition, context and species stocking rates, as per DCCEEWs *How to Use the Offset Assessment Guide*.
Total quantum of impact	513.2 ha	Based on the area of habitat multiplied by the impact quality score (as a proportion out of 10).
Offset Calculator		
Time over which loss is averted (max 20 years)	20 years	Duration of the risk mitigation actions to be taken, or 20 years, whichever is shorter.
Time until ecological benefit	20 years	The estimated time for habitat quality improvement outcomes. A conservative estimate of 20 years has been used, which captures shorter-term benefits associated with certain management strategies, as well as some of the longer-term benefits which would start to become evident by that time, i.e., weed control or vegetation improvement. This parameter will be updated following selection of the offset area and will reflect the management requirements associated with each offset value.
Start area (hectares)	3,410.5 ha (100%)	The total proposed offset area required to acquit 100 % of the land-based offset is 3,410.5 ha, with consideration of other metrics outlined in this OAG. The total area of *Cycas megacarpa* habitat mapped within the offset properties is 14,489.2 ha (424.8 % of offset area required).
Start quality (scale of 0–10)	7	The current HQS score for the offset properties is 7.6, measured across 49 habitat quality site assessments completed across properties, F1, F2 and F3. The methodology incorporates site condition, context and species stocking rates, as per DCCEEWs How to Use the Offset Assessment Guide. For the purposes of this Offset Management Strategy, a starting offset score of 7 has been selected, with the intent for the OAMP to target areas where greater opportunity for habitat quality improvement is present, including vegetation condition (growth), threat abatement and potential improvements in SSR.

Parameter	Input	Justification
Future quality without offset	-1	Without the offset, future habitat quality for *Cycas megacarpa* is conservatively assumed to decline by 1 point. This decline is anticipated based on the combination of known and active threats within the proposed offset areas, including: • Habitat clearing. • Cattle grazing. • Bushfire / wildfire from inappropriate fire regimes. General habitat quality components that comprise site condition, such as species richness, canopy cover and non-native plant cover are expected to continue to decline without the offset through the ongoing land management practices and broader region-wide threats that are known to occur. This includes selective clearing of canopy tree species, cattle grazing, ineffective weed and pest control and inappropriate fire regimes. Additionally, these threats are anticipated to lead to a gradual decline in species stocking rate for *Cycas megacarpa*. *Cycas megacarpa* seeds disperse primarily through gravity, minimising and restricting the species dispersal ability to the local area (Queensland Herbarium 2007). This species also has a naturally low recruitment rate and seedlings are particularly susceptible to destruction from predation and fire (Queensland Herbarium 2007). These factors make existing populations exceptionally vulnerable, and a decline in species stocking rates is almost inevitable without active management efforts (Queensland Herbarium 2007). The loss of *Cycas megacarpa* plants and the extent of the population through land clearing has been the most prominent cause of decline of this species over the past 200 years (Queensland Herbarium 2007). Populations that are most at risk are those in areas that have been historically cleared or are classed as cleared land (Category X areas). In Queensland, under Schedule 21 of the Planning Regulation 2017, landowners can clear unregulated vegetation mapped as Category X (non-remnant) on the regulated vegetation map for agricultural purposes. While broadscale clearing of *Cycas megacarpa* is unlikely to occur, populations are still at risk from this permitted small-scale clearing and this has been observed in the broader offset area. Without the proposed offset areas in place to secure the *Cycas megacarpa* population, the number/density of plants and extent of the population is anticipated to continue to decline. Cattle grazing on seedling and adult *Cycas megacarpa* during drought conditions when groundcover can become scarce (Queensland Herbarium 2007). This may reduce the direct density of established plants decrease germination and recruitment success, and reduce seed viability in the seed bank through trampling and soil degradation from the cattle (Queensland Herbarium 2007). Considering this species low recruitment rate, any additional threat to the success of a single recruit could impact to the generational success of the population (Queensland Herbarium 2007). Without the establishment of cattle grazing controls such as fencing and reduction of herd size in the proposed offset areas, *Cycas megacarpa* is at risk to a reduction of plants and population extent.

Parameter	Input	Justification
		Adult *Cycas megacarpa* are generally fire tolerant, with the capability to resprout post fire (Queensland Herbarium 2007). However, *Cycas megacarpa* seeds are only viable from 6 months to 3 years in the soil and both seeds and seedlings are unlikely to survive high intensity fires (Queensland Herbarium 2007). Without the establishment of the proposed Bushfire Management Plan for the offset, the *Cycas megacarpa* population is at risk of an exacerbated decline from bushfires. If consistent recruits/seedlings are damaged from predation, fire and clearing, the maintenance of, or increases to the existing population is anticipated to decline over time. The cumulation of threats as evidenced within the proposed offset areas and the broader region, including those outlined above, are reasonably anticipated to result in further decline in overall habitat quality for *Cycas megacarpa*. In particular, the impacts on seed and seedling viability and associated reduction in reproductive success, coupled with the threats to individuals in the existing population, are expected to gradually reduce species stocking rate.
Future quality with offset	+1	Future habitat quality is conservatively predicted to increase by a single point across the proposed offset area. This reflects more significant improvements in smaller areas of degraded habitat and more minor improvements likely to be seen in moderate to high quality habitat. It also reflects the active, property-level management of threats across the proposed offset area. A total of 46 habitat quality assessments have been completed across proposed offset sites, F1, F2 and F3. **Section 7.3.2.2** presents the analysis of the results from these sites that will guide management actions to increase site condition and context, in particular: Site condition: • Increase abundance of large native trees. • Increase of canopy cover. Site context: • Threat management including suitable fire management consistent with species' requirements and the acquisition and reclassification of unregulated vegetation to prevent selective logging and habitat clearing.
Confidence in result (%) – HQ	90%	A relatively high confidence in the habitat quality result is provided, noting the existing status of habitat available as predominately either remnant or regrowth. The management actions required to secure and then manage the offset areas are: • well established measures • build on and improve largely existing habitat • are not reliant on novel or uncertain restoration techniques • avoid approaches that would carry higher risk of delivery.

Parameter	Input	Justification
Risk of loss (%) without offset	2.04%	The offset areas support large areas of vegetation not currently regulated by the Queensland VM Act. These areas, particularly regrowth, are often subjected to regular, periodic or infrequent clearing. In the case of the proposed offset areas (F1, F2, F3 in particular), mapped koala habitat comprising 8,634 ha is currently unregulated (58% of total mapped habitat). Observations made by Umwelt (since 2020–2023) have recorded this land management process, resulting in the loss of MNES suitable habitat. The removal of habitat recorded during a 2 year period (782.9 ha) equates to a 2.04 % risk of loss without offset. It is noted that average background clearing rate for Rockhampton (0.69%) and Banana Shire (0.08%) (Maseyk et al. 2017) has been considered in conjunction with the habitat loss observed. This reflects an informed region and local area specific measure of risk of loss, which is considered to be the best available information to inform the offset area calculations.
Risk of loss (%) with offset	0 %	With the offset, the risk of loss is reduced to nil, by protecting the offset site through a legal mechanism. Risk of loss is not intended to reflect extreme and random loss events and, as such this is not reflected here. However, it is noted that management measures will further reduce threats to the offset site.
Confidence in result (%) – ROL	90%	The confidence in a result reflects the conservative approach that has been taken regarding RoL metrics, which incorporate background clearing rates as per Maseyk et al. (2017), and a measured local RoL reduction in vegetation / habitat across a 2 year period.

7.3.2.6 Summary

The proposed offset areas support habitat for the *Cycas megacarpa*, with confirmed populations on all properties and recorded in densities, within habitat that is commensurate with the impact area. These areas also provide opportunities for conservation gains as per the Offset Policy. This has been determined through extensive field surveys, using an approach consistent with that used in the impact area.

Using the anticipated OAG inputs described in **Table 7.7**, the offset area requirement for 100% acquittal for *Cycas megacarpa* anticipated to be 3,410.5 ha Using field verified knowledge of the offset areas, the proposed, properties are able to deliver the required offset area and achieve a suitable conservation gain for the species, as well as halting further decline and degradation.

The identification of existing threats to the species and indicative management actions will support the development of an OAMP. The OAMP will be developed after additional survey effort and further examination of offset properties. In a finalised OAMP, it is anticipated a single property or a blend of suitable habitat from several properties will enable an overall environmental improvement and counterbalance the impact to *Cycas megacarpa*.

The proposed offset areas are able to provide a direct, land-based, like-for-like offset for the species and are capable of fully acquitting the Project Significant Residual Impact to *Cycas megacarpa* habitat. As such, offsets on the identified properties are suitable, appropriate, and feasible, and able to be delivered in accordance with the Offset Policy.

7.3.3 Northern quoll

7.3.3.1 Species Presence and Habitat Availability

As shown in **Table 7.8** below, the northern quoll is known to the Study Area and the proposed offset properties. There are historical records in the region, many within 20 km and intersecting mapped biodiversity corridors (**Figure 5.2**). Baseline surveys confirmed all offset properties as supporting suitable habitat, connected to associated northern quoll movement corridors. Impacted habitat and potential offset habitat includes denning and refuge habitat. These habitat types were confirmed from each of the offset properties, with potential offset habitat areas commensurate with impacted habitat.

Table 7.8 Northern Quoll Presence and Habitat Availability

Attribute	Justification or Type	Offset Property				
		R1	R2	F1	F2	F3
Presence (record)	Known record, including desktop records	No	No	Anecdotal	Yes	No
Contiguous with record(s)	Mapped corridors or contiguous habitat with species records	Yes	Yes	Yes	Yes	Yes
Habitat	Habitat not delineated –rapid and baseline field survey, in conjunction with desk based extrapolation of state habitat mapping layers only.	22.6	60.8	N/A	N/a	N/a
Habitat Type	Denning and refuge	Known	Known	807.6	1,295.5	277.4

7.3.3.2 Habitat Quality Assessment

Area-weighted HQS for the northern quoll, including the summary of the site condition, site context and species stocking rate scores are presented in **Table 7.9** below**.** The lower HQS score for the impact site reflects the relatively smaller area of impact (less sites required) as a result of avoidance strategies taken by the Project to avoid higher denning and refuge habitat areas or second, higher quality locations habitat, such as large vine thicket patches.

Table 7.9 Northern Quoll Modified Habitat Quality Scores

Species	Matter Unit/ Habitat Utilisation	Impact				Offset			
		Cnd	Cxt	SSR	HQS	Cnd	Cxt	SSR	HQS
Maximum score		**3**	**3**	**4**	**10**	**3**	**3**	**4**	**10**
Northern quoll	Denning and refuge	1.3	1.6	2.1	**5.0**	2.0	2.2	2.5	**6.7**

7.3.3.3 Conservation Gain

Northern quoll denning and refuge habitat was manually delineated by expert analysis incorporating field data and specifically, the presence of refuge microhabitat such as rocky outcrops and other high-density denning habitat features in conjunction with high-resolution satellite imagery to identify hilly and rocky habitats such as gullies, creek lines and structurally diverse woodlands. This MU was further delineated into assessment units by the vegetation condition state including remnant or regrowth condition. The final HQS was area-weighted according to the proportion of each vegetation condition class within the denning and refuge habitat. The area-weighted HQS within across the offset properties for denning and refuge habitat was 6.7 for the offset site. A summary of the species-specific habitat quality attributes are presented in **Table 7.10** below. Scoring for these attributes were well below the maximum demonstrating opportunity to improve the overall HQS. This validates that there are active threats present in the proposed offset areas, impacting habitat quality for the species, and that targeted offset interventions are needed.

A further analysis of some of the species-specific habitat quality sub-attributes is presented in **Table 7.11** below and demonstrates the opportunity for HQS improvement within the threat sub-attributes.

Table 7.10 Summary of the Key Habitat Quality Scores for Northern Quoll within the Offset Areas Only

Matter Unit	HQS	HQ Component	Attribute	Scores		
				Average	Max	Difference
Northern Quoll Denning and refuge	6.7	Site condition	Quality and Availability of Food and Habitat Required for Foraging	5.7	10	**4.3**
			Quality and Availability of Habitat Required for Shelter and Breeding	4.7	10	**5.3**
		Site context	Quality and Availability of Habitat Required for Mobility	7.8	10	2.2
			Absence of Threats	2.9	15	**7.1**
		Species stocking rate (all attributes)		43.8	70	26.2

Table 7.11 Summary of the Species-Specific Habitat Quality Results Throughout the Offset

Attribute	Sub-Attribute	Denning and Refuge*		
		Avg.	Max	Diff
Quality and Availability of Food and Habitat Required for Foraging	Presence of suitable microhabitat for prey species (hollows, hollow logs, fallen timber, rocks, coarse woody debris, organic litter)	5.7	10.0	**4.3**
Quality and Availability of Habitat Required for Shelter and Breeding	Presence of large hollow logs	0.8	2.0	1.2
	Presence of large trees (Benchmark)	0.8	2.0	1.2
	Presence of termite mounds	0.1	1.0	0.9
	Presence of rocky outcrops and rock crevices	1.3	5.0	3.7
Quality and Availability of Habitat Required for Mobility	Habitat patch connectivity	9.5	10.0	0.5
Threats	Feral animal predation	6.0	15.0	**9.0**
	Cane toads	7.4	15.0	**7.6**
	Wildfire damage	8.6	15.0	**6.4**

** Scores comprise averaged scores, rather than area-weighted averaged.*

Species Stocking Rate

A summary of species stocking rate scoring is provided within **Table 7.12**. The results of the targeted field surveys indicate a low density presence of northern quoll. Therefore, the species was assigned a score of 5 for presence detected. Comparatively, the matter scored moderately for approximate density as this score is inferred by carrying capacity. Species usage was assigned for habitat mapping type with breeding and denning scoring maximum points. Finally, the species was assigned 30/45 points for the role/ importance of species population on site due to the populations' significance having persisted following exposure to cane toads and importance to genetic diversity, population breeding and dispersal as the location is within a state-recognised ecological corridor.

Table 7.12 identifies the species stocking rate scoring sub-attributes with potential for further improvement (grey cells). In summary, the species stocking rate score will improve with further detections throughout the offset area and as the vegetation matures and species-specific habitat quality attributes develop and improve over time (increase to approximate density).

Table 7.12 Summary of the Results of the Species Stocking Rate Sub-Attributes within the Offset Areas

SSR Attribute	Details/ Sub-Attribute	DR		
		Avg.	Max	Diff
Presence detected on or adjacent to site	Detection within matter unit, Study Area / Offset Property or adjacent	5	10	**5**
Species usage of the site	Habitat mapping type and connectivity to breeding and refuge.	15	15	0

SSR Attribute	Details/ Sub-Attribute	DR		
		Avg.	Max	Diff
Approximate density	Inferred, based on various metrics including carrying capacity potential. As per **Section 5.4.2**.	13.8	30	**16.2**
Role/ importance of species population on site – Supplementary SSR table	Key source for population breeding	10	10	0
	Key source population for dispersal	5	5	0
	Necessary for maintaining genetic diversity	15	15	0
	Near the limit of the species range	0	15	15

7.3.3.4 Threats

A summary of key threats recorded within each offset area is provided below. There are several threats present in the proposed offset areas that all contribute to a reduction in habitat quality for the species. As such, if management actions are employed for a single threat, such as habitat clearing, and not others, such as managing wildfire or feral animal predation, the overall threat score may not increase significantly. Therefore, an integrated offset management approach that includes the consideration and active management of a range of threats is needed.

- Cane Toad: scored at a site level with the scope calculated based on the elevation, distance to water and maturity of vegetation. Therefore, this threat score will improve as vegetation regenerates from non-remnant to regrowth to remnant state and/or the abundance of prey microhabitat features increases.
- Wildfire Damage: calculated at a monitoring site level and can be improved with active fire management such as implementing fire regimes consistent with RE guidelines and constructing and maintaining firebreaks or access tracks for emergency response personnel.
- Feral Animal Predation and/or Control: calculated at a monitoring site level and can be improved if continuous feral animal management and monitoring actions can be implemented throughout the offset areas.

Associated Management Actions

Indicative management actions providing direction to counteract existing threats were identified and are listed below:

- In-perpetuity protection within offset area – legally secured.
    - This elevates the regulatory status of an area to a MSES thus increasing the legal protection of the species' habitat. Moreover, unregulated vegetation clearing within areas mapped as cleared land/ Category X will no longer be permitted allowing the vegetation within these sites to regenerate and provide the structural and compositional values measured within the site condition attributes.

- Species-appropriate bushfire management plan implemented.
    - Both reduces the risk of wildfire-induced habitat degradation by the construction and maintaining suitable firebreaks/ emergency access and fuel-reduction burns. Moreover, the implementation of fire regimes consistent with RE guidelines will maintain suitable microhabitat features characteristic of each vegetation community. For example, burn off understory fuel load matter before it can accumulate and result in a very hot burn which may remove hollow logs or other foraging and denning microhabitat features.
- Targeted pest and weed control implemented.
    - Feral animals will be competing for prey with the northern quoll and potentially directly predating upon them. This may reduce the carrying capacity of the site, particularly following disturbance events that may limit prey abundance such as extended drought conditions.
- Improvement to vegetation condition – enhanced foraging, shelter and breeding habitat.
    - Cattle grazing is the dominant land-use of the study area and is likely continuing to degrade the native vegetation condition and/or inhibit the regeneration capacity of already highly degraded areas. Therefore, implementing strategies to limit grazing pressure throughout various areas will likely see an improvement of the vegetation condition reflected within the site condition attributes.
    - Increase abundance of shelter habitat through the retention and translocation of habitat logs, woody debris and rocky scree from the impact area into offset area.
- Enhanced landscape connectivity – prioritisation of regrowth woodlands for offset areas.
    - Improves the carrying capacity of both the highly degraded areas which do not currently provide habitat and improves the value of current habitat by increasing foraging, breeding and/ or dispersal resources.
- Enhanced landscape connectivity – prioritisation of regrowth woodlands for offset areas.
    - Improves the carrying capacity of both the highly degraded areas which do not currently provide habitat and improves the value of current habitat by increasing foraging, breeding and/ or dispersal resources.

7.3.3.5 Offset Assessment Guide Calculations

The offset assessment guide inputs relevant to northern quoll are provided in **Table 7.13**.

Table 7.13 OAG Inputs for Northern Quoll

Parameter	Input	Justification
EPBC Act Status	Endangered	Effective 12 April 2005
Annual probability of extinction	1.2%	As per OAG
Impact Calculator		
Area of habitat	22.1	As detailed in Attachment B4 (Assessment of Matters of National Environmental Significance).
Quality	5	Recorded across 2 habitat quality site assessments and completed in accordance with the methodology described in this Offset Management Strategy. The methodology incorporates site condition, context and species stocking rates, as per DCCEEWs How to Use the Offset Assessment Guide.
Total quantum of impact	11.05	Based on the area of habitat multiplied by the impact quality score (as a proportion out of 10).
Offset Calculator		
Time over which loss is averted (max 20 years)	20 years	Duration of the risk mitigation actions to be taken, or 20 years, whichever is shorter.
Time until ecological benefit	20 years	The estimated time for habitat quality improvement outcomes. A conservative estimate of 20 years has been used, which captures shorter-term benefits associated with certain management strategies, as well as some of the longer-term benefits which would start to become evident by that time, i.e. weed control or vegetation improvement. This parameter will be updated following selection of the offset area and will reflect the management requirements associated with each offset value.
Start area (hectares)	76.4 ha (100 % acquittal)	The total proposed offset area required to acquit 100 % of the land-based offset is 76.4 ha, with consideration of other metrics outlined in this OAG. The total area of northern quoll habitat mapped within the offset properties is 2,463.9 ha (3,225 % of offset area required).
Start quality (scale of 0–10)	7	Recorded across 17 habitat quality site assessments completed across proposed offset sites, F1, F2 and F3, in accordance with the methodology described in this Offset Management Strategy. The methodology incorporates site condition, context and species stocking rates, as per DCCEEWs How to Use the Offset Assessment Guide.

Parameter	Input	Justification
Future quality without offset	-1	Without the offset, future habitat quality for the northern quoll is conservatively assumed to decline by 1-point. This decline is anticipated based on the combination of known and active threats within the proposed offset areas, including: • Loss or degradation of habitat from clearing, fires and overgrazing. • Predation from cats, foxes and raptors. • Ingestion of cane toad. The northern quoll requires established groundcover (shrub cover, native grass cover and large woody debris) for foraging, denning and protection from predators (Hill & Ward 2010, DotE 2016). Vegetation clearing (selective or small-scale), as well as removal or loss of shrub cover and understorey complexity, decreases the availability of these microhabitat features and presents a risk of direct mortality (Hill & Ward 2010, DotE 2016). Additionally, the reduction of shelter (in the form of canopy cover and woody debris) increases exposure and susceptibility to predation (Hill & Ward 2010, DotE 2016). Cattle grazing is recognised as a threat to the species, particularly as it relates to removal of ground-level vegetation (Moore et al., 2022) Given the above, selective logging or small-scale clearing of canopy trees, removal of ground-level vegetation, ongoing management of mapped Category X vegetation, and cattle grazing is reasonably anticipated to continue and contribute to a cumulative decline in habitat quality and associated risk of species stocking rate decline. As the northern quoll is a ground-dwelling species that requires high habitat complexity, it is particularly susceptible to impacts from fire (Hill & Ward 2010, DotE 2016). Planned burns that are too frequent or high intensity bushfires change vegetation structure and floristics (Hill & Ward 2010). For example, these fires usually reduce or remove shrub layer cover and species diversity, as well as result in the loss of microhabitats on the ground such as large woody debris that the northern quoll relies on (Hill & Ward 2010). Conversely, planned burns that are too infrequent or non-existent lead to the build up of fuel loads and increased bushfire intensity (Hill & Ward 2010). Intense bushfires pose a much higher risk to loss of habitat and mortality of the northern quoll, having the potential to lose canopy and shrub cover and species richness, as well as the microhabitat features mentioned above (Hill & Waed 2010). No formalised planned burn regime is currently documented for the proposed offset properties. Additionally, the species requires a fire management program that specifically considers the species and its sensitivity to fire, rather than a typical landscape approach. Without the establishment of the proposed Bushfire Management Plan for the offset, the northern quoll habitat condition in the proposed offset areas are at risk of further degradation or loss from bushfires and/or inappropriate planned burn regimes. The cumulation of threats as evidenced within the proposed offset areas and the broader region, including those outlined above, are reasonably anticipated to result in ongoing decline in habitat quality for the northern quoll. Rather than leading to broadscale loss of habitat for the quoll, the continuation of threats will gradually reduce the complexity and quality of habitat for the species.

Parameter	Input	Justification
		Northern quolls prefer areas with high structural diversity and habitat degradation through inappropriate fire regimes, clearing, heavy grazing regimes, and predation will reduce this complexity and the quality of habitat (Hill & Ward 2010). Components of site condition, site context and species stocking rate such as tree and shrub canopy cover, understorey complexity, native grass cover, coarse woody debris and quality and availability of foraging and shelter habitat will continue to decline without the offset.
Future quality with offset	+1	Future habitat quality is conservatively predicted to increase by a single point across the proposed offset area. This reflects more significant improvements in smaller areas of degraded habitat and more minor improvements likely to be seen in moderate to high quality habitat. It also reflects the active, property-level management of threats across the proposed offset area. A total of 17 habitat quality assessments have been completed across proposed offset sites, F1, F2 and F3. As shown in **Section 7.3.3.2**, improvements in habitat quality are available across all three HQ components including: Site condition: • Abundance of prey microhabitat features that can reasonably be expected to improve naturally as vegetation is left to regenerate including hollows, hollow logs, fallen timber and organic litter. • Increase abundance of large trees and large hollow logs. Site context: • Threat management including feral animal control, assisted natural regeneration of vegetation and suitable fire management consistent with species' requirements. Species stocking rate: • Recording the species throughout other areas of the offset to increase the presence detected value.
Confidence in result (%) – HQ	90 %	A relatively high confidence in the habitat quality result is provided, noting the existing status of habitat available as either remnant or regrowth. The management actions required to secure and then manage the offset areas are: • well established measures • build on and improve largely existing habitat • are not reliant on novel or uncertain restoration techniques • avoid approaches that would carry higher risk of delivery.

Parameter	Input	Justification
Risk of loss (%) without offset	0.69%	Whilst the clearing of unregulated vegetation is an active threat to the species, denning and refuge habitat is largely avoided due to the terrain or overlap with steep slopes and gullies. Clearance of waterway vegetation and structurally complex woodlands is occurring via selective logging. For this reason, the average background clearing rate for Rockhampton (0.69%) and Banana Shire (0.08%) (Maseyk et al. 2017) as been assigned as RoL without offset.
Risk of loss (%) with offset	0 %	With the offset, the risk of loss is reduced to nil, by protecting the offset site through a legal mechanism. Risk of loss is not intended to reflect extreme and random loss events and, as such this is not reflected here. However, it is noted that management measures will further reduce threats to the offset site.
Confidence in result (%) – ROL	90 %	The confidence in a result reflects the conservative approach that has been taken regarding RoL metrics, which incorporate background clearing rates as per Maseyk et al. (2017).

7.3.3.6 Summary

The proposed offset areas support habitat for the northern quoll, commensurate with the impact area habitat and comprising denning and refuge habitat. These areas also provide opportunities for conservation gains as per the Offset Policy. This has been determined through extensive field surveys, using an approach consistent with that used in the impact area.

Using the anticipated OAG inputs, the offset area requirement for 100% acquittal for the northern quoll is anticipated to be 76.4 ha. Using field verified knowledge of the offset areas, the proposed properties are able to deliver the required offset area and achieve a suitable conservation gain for the species, as well as halting further decline and degradation.

The identification of existing threats to the species and indicative management actions will support the development of an OAMP. The OAMP will be developed after additional survey effort and further examination of offset properties. In a finalised OAMP, it is anticipated a single property or a blend of suitable habitat from several properties will enable an overall environmental improvement and counterbalance the impact to northern quoll.

The proposed offset areas are able to provide a direct, land-based, like-for-like offset for the species and are capable of fully acquitting the Project Significant Residual Impact to northern quoll habitat. As such, offsets on the identified properties are suitable, appropriate, and feasible, and able to be delivered in accordance with the Offset Policy.

7.3.4 Greater glider (southern and central)

7.3.4.1 Species Presence and Habitat Availability

As shown in **Table 7.14** below, the greater glider (southern and central) is known to the Study Area and the proposed offset properties. Impacted habitat and potential offset habitat has been delineated into three types, being potential/ future breeding and denning, likely/ current breeding and denning and foraging and dispersal. These habitat types were confirmed across the offset properties, with potential offset habitat areas commensurate with impacted habitat types.

Table 7.14 Greater glider (southern and central) Presence and Habitat Availability

Attribute	Justification or Type	Offset Property				
		R1	R2	F1	F2	F3
Presence (record)	Known record, including desktop records	No	Yes	No	No	Yes
Contiguous with record(s)	Mapped corridors or contiguous habitat with species records	Yes	Yes	Yes	Yes	Yes
Habitat	Habitat not delineated –rapid and baseline field survey, in conjunction with desk based extrapolation of state habitat mapping layers only.	53.3	2,175.4	N/A	N/A	N/A
Habitat Type	Potential/ future breeding and denning	Known	Known	1,101.0	545.6	1,483.2
	Likely/ current breeding and denning	Known	Known	2,150.2	3,275.0	483.8
	Foraging and dispersal	Known	Known	1,061.7	2,654.9	2,276.8

7.3.4.2 Habitat Quality Assessment

Greater glider (southern and central) habitat was separated into three matter units/ habitat utilisation types including:

- Potential/ future breeding and denning.
- Likely/ current breeding and denning.
- Foraging and dispersal (FD) habitat.

The area-weighted HQS for these matter units, including the summary of site condition, site context and species stocking rate scores are presented in **Table 7.15** below**.**

Table 7.15 Greater glider (southern and central) Habitat Quality Assessment

Species	Matter Unit/ Habitat Utilisation	Impact				Offset			
		Cnd	Cxt	SSR	HQS	Cnd	Cxt	SSR	HQS
Maximum score		**3**	**3**	**4**	**10**	**3**	**3**	**4**	**10**
Greater glider (southern and central)	Potential/ future breeding and denning	1.7	2.1	2.1	**5.9**	2.1	2.1	2.6	**6.8**
	Likely/ current breeding and denning	2.2	2.0	2.7	**6.9**	2.2	2.2	3.0	**7.4**
	Foraging and dispersal	1.9	1.5	1.9	**5.3**	1.8	1.9	1.6	**5.3**

7.3.4.3 Conservation Gain

With vegetation maturity criteria a key component of the habitat mapping criteria, both the likely/current breeding and denning and the potential/future breeding and denning MUs consisted of a single assessment unit, whilst the foraging and dispersal habitat was further delineated into regrowth and cleared land condition classes. Species-specific attributes, as scored for the offset properties as per the MHQA are presented in **Table 7.16** below. The scoring shows that threats scored low across all matter units. This demonstrates that there are active threats present in the proposed offset areas, impacting habitat quality for the species, and that targeted offset interventions are needed.

Further analysis of the sub-attributes is also provided in **Table 5.17** below. This table demonstrates the opportunity for habitat quality improvement within the threat, shelter and breeding and mobility sub-attributes.

Table 7.16 Summary of the Key Habitat Quality Offset Scores for greater glider (southern and central)

Matter unit	HQS	HQ Component	Attribute	Scores		
				Average	Max	Difference
Greater glider (southern and central) –Foraging and dispersal	5.3	Site condition	Quality and Availability of Food and Habitat Required for Foraging	7.7	10	2.3
			Quality and Availability of Habitat Required for Shelter and Breeding	5.3	10	**4.7**
		Site context	Quality and Availability of Habitat Required for Mobility	4.7	10	**5.3**
			Absence of Threats	2.3	15	**12.7**
		Species stocking rate (all attributes)		27.5	70	**42.5**
Greater glider (southern and central) – Potential/ Future Breeding and denning	6.8	Site condition	Quality and Availability of Food and Habitat Required for Foraging	9.7	10	0.3
			Quality and Availability of Habitat Required for Shelter and Breeding	6.6	10	**3.7**
		Site context	Quality and Availability of Habitat Required for Mobility	8.2	10	1.8
			Absence of Threats	2.5	15	**12.5**
		Species stocking rate (all attributes)		45.9	70	**24.1**
Greater glider (southern and central) – Likely/ Current Breeding and denning	7.4	Site condition	Quality and Availability of Food and Habitat Required for Foraging	9.4	10	0.6
			Quality and Availability of Habitat Required for Shelter and Breeding	7.3	10	**2.7**
		Site context	Quality and Availability of Habitat Required for Mobility	10.0	10	0.0
			Absence of Threats	2.6	15	**12.4**
		Species stocking rate (all attributes)		51.8	70	**18.2**

Table 7.17 Summary of the Species-Specific Sub-Attribute Results within the Offset Areas Only

Attribute	Sub-attribute	Foraging and dispersal*			Potential/ future denning*			Likely/ current denning*		
		Avg.	Max	Diff	Avg.	Max	Diff	Avg.	Max	Diff
Quality and Availability of Food and Habitat Required for Foraging	Presence of large trees (>30 cm dbh)	2.9	5.0	**2.1**	4.8	5.0	0.2	4.9	5.0	0.1
	Presence of habitat trees	4.8	5.0	0.2	4.9	5.0	0.1	4.5	5.0	0.5
Quality and Availability of Habitat Required for Shelter and Breeding	Presence of habitat tree species (large trees >50 cm dbh)	2.4	5.0	**2.6**	3.2	5.0	1.8	3.2	5.0	1.8
	Presence of habitat tree species (large trees >50 cm dbh)	2.9	5.0	2.1	3.5	5.0	1.5	4.1	5.0	0.9
Quality and Availability of Habitat Required for Mobility	Size of habitat patch	5.0	10.0	**5.0**	8.2	10.0	1.8	10.0	10.0	0.0
Threats	Habitat clearing	3.9	15.0	**11.1**	5.1	15.0	**9.9**	4.0	15.0	**11.0**
	Wildfire damage	9.3	15.0	**5.7**	7.2	15.0	**7.8**	6.6	15.0	**8.4**
	Feral animal predation and/or control	10.0	15.0	**5.0**	10.0	15.0	**5.0**	10.0	15.0	**5.0**

** All scores comprise averaged scores, rather than area-weighted averaged.*

Species Stocking Rate

A summary of species stocking rate scoring is provided within **Table 7.18**. The results of the targeted field surveys have reflected scoring results, indicating a patchy distribution of greater glider (southern and central)s throughout the proposed offset area. This is demonstrated in the species usage scores, which ranged from 2.5 to 15. Comparatively, approximate density showed the same pattern with likely/current denning scoring the highest as the vegetation and species-specific habitat attributes provide the necessary foraging, breeding and mobility features necessary for the species. Finally, the role/ importance of species population scored 5/15 as the population is neither near the range or considered necessary for maintaining genetic diversity.

Table 7.18 identifies scoring attributes with potential for further improvement (grey cells). In summary, improvements will be observed in the species stocking rate score as vegetation regenerates and develops more of the species-specific microhabitat features key to foraging, shelter and breeding and mobility.

Table 7.18 Summary of the Results of the Species Stocking Rate Sub-Attributes within the Offset Areas Only

SSR Attribute	Details/ Sub-attribute	Foraging and Dispersal			Potential / Future Denning Habitat			Likely / Current Denning Habitat		
		Avg.	Max	Diff	Avg.	Max	Diff	Avg.	Max	Diff
Presence detected on or adjacent to site	Detection within matter unit, Study Area / Offset Property or adjacent	10	10	0	9.4	10	0.6	9.7	10	0.3
Species usage of the site	Habitat mapping type	4.7	15	10.3	10	15	**5**	15	15	0
Approximate density	Inferred, based on various metrics including carrying capacity potential. As per **Section 5.4.2**.	7.8	30	**22.2**	21.2	30	**8.8**	22.4	30	**7.6**
Role/ importance of species population on site – Supplementary SSR table	Key source for population breeding	10	10	0	10	10	0	10	10	0
	Key source population for dispersal	5	5	0	5	5	0	5	5	0
	Necessary for maintaining genetic diversity	0	15	15	0	15	15	0	15	15
	Near the limit of the species range	0	15	15	0	15	15	0	15	15

7.3.4.4 Threats

A summary of key threats recorded within each offset area is provided below. There are several threats present in the proposed offset areas that all contribute to a reduction in habitat quality for the species. As such, if management actions are employed for a single threat, such as habitat clearing, and not others, such as managing wildfire or feral animal predation, the overall threat score may not increase significantly. Therefore, an integrated offset management approach that includes the consideration and active management of a range of threats is needed.

- **Habitat Clearing**: calculated at a monitoring site level, with threats immediately possible through legal securement as Category A restricted vegetation under the VM Act. Offset area management plans will prevent the ongoing impact of selective logging and regrowth management. Across the offset areas, habitat clearing has comprised over 782.9 ha within a two year period. This is largely due to the unrestricted nature of vegetation (Category X designation).

- **Wildfire Damage**: calculated at a monitoring site level and can be improved with active fire management such as implementing fire regimes consistent with RE guidelines and constructing and maintaining firebreaks or access tracks for emergency response personnel.

- **Feral Animal Predation and/or Control:** calculated at a monitoring site level and can be improved if continuous feral animal management and monitoring actions can be implemented throughout the offset areas.

Associated Management Actions

Indicative management actions for the proposed offset area to counteract existing threats are listed below:

- In-perpetuity protection within offset area – legally secured.
    - This elevates the regulatory status of an area to a MSES thus increasing the legal protection of the species' habitat. Moreover, unregulated vegetation clearing within areas mapped as cleared land/ Category X will no longer be permitted allowing the vegetation within these areas to regenerate and improve the structural and compositional values measured within the site condition attributes.
- Species-appropriate bushfire management plan implemented.
    - Both reduces the risk of wildfire-induced habitat degradation by construction and maintaining suitable firebreaks/ emergency access and fuel-reduction burns. Moreover, the implementation of fire regimes consistent with RE guidelines will maintain suitable microhabitat features characteristic of each vegetation community. For example, prevent a very dense subcanopy and/or tall shrub understorey of shrubs which can limit glider paths, potentially inhibit movement and cause the species to traverse on ground more frequently.
- Targeted pest and weed control implemented – targeted dingo / wild dog populations.
    - As the scores indicate, feral animal predation is not expected to be the most prevalent threat for the species considering it is both arboreal and not considered common prey to fox, dog or cats. However, feral animal predation can increase significantly after fire and should therefore be considered within the prescribe fire regime.
- Improvement to vegetation condition – enhanced foraging, shelter and breeding habitat.
    - Cattle grazing is the dominant land-use of the study area and is likely continuing to degrade the native vegetation condition and/or inhibit the regeneration capacity of already highly degraded areas. Therefore, implementing strategies to limit grazing pressure throughout various areas will likely see an improvement of the vegetation condition reflected within the site condition attributes. This will have the greatest impact on the foraging and dispersal MU which only contains very young emerging regrowth to moderately mature regrowth vegetation.
- Enhanced landscape connectivity – prioritisation of regrowth woodlands for offset areas.
    - Improves the carrying capacity of both the highly degraded areas which do not currently provide habitat and improves the value of current habitat by increasing connectivity and overall foraging, breeding and/ or dispersal resources.

7.3.4.5 Offset Assessment Guide Calculations

Offset assessment guide inputs relevant to greater glider (southern and central) are provided in **Table 7.19**.

Table 7.19 OAG Inputs for Greater glider (southern and central)

Parameter	Input	Justification
EPBC Act Status	Endangered	Effective 5 July 2022
Annual probability of extinction	1.2%	As per OAG
Impact Calculator		
Area of habitat	627.9 ha	As detailed in Attachment B4 (Assessment of Matters of National Environmental Significance).
Quality	6	Recorded across 22 habitat quality site assessments and completed in accordance with the methodology described in this Offset Management Strategy. The methodology incorporates site condition, context and species stocking rates, as per DCCEEWs How to Use the Offset Assessment Guide.
Total quantum of impact	376.74 ha	Based on the area of habitat multiplied by the impact quality score (as a proportion out of 10).
Offset Calculator		
Time over which loss is averted (max 20 years)	20 years	Duration of the risk mitigation actions to be taken, or 20 years, whichever is shorter.
Time until ecological benefit	20 years	The estimated time for habitat quality improvement outcomes. A conservative estimate of 20 years has been used, which captures shorter-term benefits associated with certain management strategies, as well as some of the longer-term benefits which would start to become evident by that time, i.e. weed control or vegetation improvement. This parameter will be updated following selection of the offset area and will reflect the management requirements associated with each offset value.
Start area (hectares)	2,528 ha	The total proposed offset area required to acquit 100 % of the land-based offset is 2,528 ha, with consideration of other metrics outlined in this OAG. The total area of greater glider (southern and central) habitat mapped within the offset properties is 17,260.9 ha (~682 % of offset area required).
Start quality (scale of 0–10)	6	Starting habitat quality score of 6 as area-weighted across three matter units, foraging and dispersal (40%), potential/ future denning (39%) and likely/ current denning (21%). Recorded across 57 habitat quality site assessments completed across proposed offset sites, F1, F2 and F3, in accordance with the methodology described in this Offset Management Strategy. The methodology incorporates site condition, context and species stocking rates, as per DCCEEWs How to Use the Offset Assessment Guide.

Parameter	Input	Justification
Future quality without offset	-1	Without the offset, future habitat quality for the greater glider (southern and central) is conservatively assumed to decline by 1 point. This decline is anticipated based on the combination of known and active threats within the proposed offset areas, including: • Selective clearing. • Cattle grazing. • Inappropriate fire regimes. The selective clearing of canopy tree species occurs in the proposed offset areas and is anticipated to continue without the offset. The loss or degradation of habitat, particularly loss of hollow bearing canopy species, is one of the more significant threats to the greater glider (southern and central) and takes many years to recover (DCCEEW 2022, Eyre et al. 2022). Ongoing selective clearing of canopy species before they have the chance to fully re-establish, will result in a cumulative decline over time. Therefore, selective clearing of canopy tree species will result in a gradual and cumulative decline in hollows, canopy cover, and overall foraging and denning resources available for the greater glider (southern and central), and reduced species density (DCCEEW 2022, Eyre et al. 2022). Additionally, in Queensland, under Schedule 21 of the Planning Regulation 2017, landowners can clear vegetation mapped as Category X (non-remnant) on the regulated vegetation map for agricultural purposes. While these areas may significantly regenerate between clearing events, they are usually reclaimed as cleared land for agricultural purposes, as observed within the proposed offset areas. Reclamation of mapped Category X vegetation is reasonably anticipated to continue and contribute to a cumulative decline in habitat quality for the greater glider (southern and central), particularly in regard to foraging resources. Cattle grazing reduces the successful recruitment of Eucalyptus species, reducing the quality and availability of foraging and shelter habitat in the long term for greater gliders (southern and central) (DCCEEW 2022). Cattle grazing in the proposed offset areas are likely to contribute to the culminating decrease of foraging and shelter habitat for the greater glider (southern and central). Greater gliders (southern and central) are sensitive to fire and fire frequency and intensity greatly impacts habitat quality for the species and influences the species density (McLean et al., 2018, DCCEEW 2022). For example, research has found a single fire in a ten-year period is capable of reducing the abundance of greater gliders (southern and central) by more than half (McLean et al. 2018). Inappropriate planned burn regimes and management of fuel loads leads to increased bushfire impact risk to the greater glider (southern and central), including loss of canopy species, foraging species richness and therefore a reduction in quality and available of foraging and shelter habitat (DCCEEW 2022). No formalised planned burn regime is currently documented for the proposed offset properties.

Parameter	Input	Justification
		Additionally, the species requires a fire management program that specifically considers the species and its sensitivity to fire, rather than a typical landscape approach. Without the establishment of the proposed Bushfire Management Plan for the proposed offset areas with species-specific considerations, the greater glider (southern and central) species stocking rate and habitat condition in the proposed offset areas are at risk of further decline or loss from bushfires (DCCEEW 2022, NSW Scientific Committee 2014). The cumulation of threats as evidenced within the proposed offset areas and the broader region, including the key threats outlined above, are reasonably anticipated to result in further decline in habitat quality for the greater glider (southern and central). Components of site condition, site context and species stocking rate, such as, presence and abundance of hollows, canopy height and cover, species richness and quality and availability of foraging and shelter habitat will continue to decline without the offset
Future quality with offset	+1	Future habitat quality is conservatively predicted to increase by a single point across the proposed offset area. This reflects the expected significant improvements in smaller areas of degraded habitat and minor improvements within moderate to high quality habitat. As presented in **Section 7.3.4.2**, there are opportunities to improve sub-attributes within the site condition, site context and species-stocking rate components of the HQS, including: Site condition: • Density of large foraging and habitat trees. Site context: • Increased size of habitat patches as adjacent cleared areas regenerates towards foraging and dispersal habitat. • Threat management including feral animal control, acquisition and reclassification of unregulated vegetation to prevent selective logging and habitat clearing and suitable fire management consistent with species' requirements. Species stocking rate: • Improved species usage as the abundance of large trees increases within potential/future denning habitat and elevates this habitat mapping into likely/current denning habitat.
Confidence in result (%) – HQ	90%	57 habitat quality assessments have been completed across proposed offset sites, F1, F2 and F3. These sites have informed required management actions to lift site condition, context and stocking rate. Further effort to map and characterise population density may also increase the stocking rate scoring.

Parameter	Input	Justification
Risk of loss (%) without offset	2.04%	The offset areas support large areas of vegetation not currently regulated by the Queensland VM Act. These areas, particularly regrowth, are often subjected to regular, periodic or infrequent clearing. In the case of the proposed offset areas (F1, F2, F3 in particular), mapped greater glider (southern and central) habitat comprising 9,108.7 ha is currently unregulated (52.7 % of total greater glider (southern and central) habitat). Observations made by Umwelt (since 2020–2023) have recorded this land management process, resulting in the loss of suitable MNES habitat (including emergent habitat types). The removal of habitat recorded during a 2 year period (782.9 ha) equates to a 2.04 % risk of loss without offset. It is noted that average background clearing rate for Rockhampton (0.69%) and Banana Shire (0.08%) (Maseyk et al. 2017) has been considered in conjunction with the habitat loss observed. This reflects an informed region and local area specific measure of risk of loss, which is considered to be the best available information to inform the offset area calculations.
Risk of loss (%) with offset	0%	With the offset, the risk of loss is reduced to nil, by protecting the offset site through a legal mechanism. Risk of loss is not intended to reflect extreme and random loss events and, as such this is not reflected here. However, it is noted that management measures will further reduce threats to the offset site.
Confidence in result (%) – ROL	90%	The confidence in a result reflects the conservative approach that has been taken regarding RoL metrics, which incorporate background clearing rates as per Maseyk et al. (2017), and a measured local RoL reduction in vegetation / habitat across a 2 year period.

7.3.4.6 Summary

The proposed offset areas support habitat for the greater glider (southern and central), commensurate with the impact area habitat and comprising likely/current and potential/future breeding and denning habitat, as well as foraging and dispersal habitat. These areas also provide opportunities for conservation gains as per the Offset Policy. This has been determined through extensive field surveys, using an approach consistent with that used in the impact area.

Using the anticipated OAG inputs, the offset area requirement for 100% acquittal for the greater glider (southern and central) is anticipated to be 2,528 ha. Using field verified knowledge of the offset areas, the proposed properties are able to deliver the required offset area and achieve a suitable conservation gain for the species, as well as halting further decline and degradation.

The identification of existing threats to the species and indicative management actions will support the development of an OAMP. The OAMP will be developed after additional survey effort and further examination of offset properties. In a finalised OAMP, it is anticipated a single property or a blend of suitable habitat from several properties will enable an overall environmental improvement and counterbalance the impact to greater glider (southern and central).

The proposed offset areas are able to provide a direct, land-based, like-for-like offset for the species and are capable of fully acquitting the Project Significant Residual Impact to greater glider (southern and central) habitat. As such, offsets on the identified properties are suitable, appropriate, and feasible, and able to be delivered in accordance with the Offset Policy.

7.3.5 Yellow-bellied glider (south-eastern)

7.3.5.1 Species Presence and Habitat Availability

As shown in **Table 7.20** below, the yellow-bellied glider (south-eastern) is known to the Study Area and the proposed offset properties (F3). There are a number of historical records in the region, between 10 and 15 km of the impact Study area, sharing connective pathways with habitat in the proposed offset properties. Impacted habitat and potential offset habitat has been delineated into two types, being breeding and denning and foraging and dispersal. These habitat types were confirmed from each of the offset properties, with potential offset habitat areas commensurate with impacted habitat types.

Table 7.20 Yellow-bellied glider (south-eastern) Presence and Habitat Availability

Attribute	Justification or Type	Offset Property				
		R1	R2	F1	F2	F3
Presence (record)	Known record, including desktop records	No	No	No	No	Yes
Contiguous with record(s)	Mapped corridors or contiguous habitat with species records	Yes	Yes	Yes	Yes	Yes
Habitat	Habitat not delineated –rapid and baseline field survey, in conjunction with desk based extrapolation of state habitat mapping layers only.	45.1	1,541.6	N/A	N/a	N/a
Habitat Type	Breeding and denning	Known	Known	583.2	730.1	1,676.9
	Foraging and dispersal	Known	Known	783.0	3,622.2	1500.8

7.3.5.2 Habitat Quality Assessment

Yellow-bellied glider (south-eastern) habitat was separated into two matter units (MUs) including:

1. breeding and denning habitat
2. foraging and dispersal habitat.

The area-weighted HQS for these matter units, including the summary of site condition, site context and species stocking rate scores are presented in **Table 7.21** below**.**

Table 7.21 Yellow-bellied glider (south-eastern) Habitat Quality Assessment

Species	Matter Unit/ Habitat utilisation	Impact				Offset			
		Cnd	Cxt	SSR	HQS	Cnd	Cxt	SSR	HQS
Maximum score		**3**	**3**	**4**	**10**	**3**	**3**	**4**	**10**
Yellow-bellied glider (south-eastern)	Breeding and denning	2.3	1.8	2.6	**6.6**	2.0	2.0	2.1	**6.2**
	Foraging and dispersal	1.8	1.7	2.0	**5.4**	1.9	1.9	1.7	**5.6**

7.3.5.3 Conservation Gain

Of the two MUs for the species, various condition states resulted in the delineation into three assessment units, including emerging habitat which represent areas expected to develop into suitable habitat within 20 years, and foraging and dispersal/ breeding and denning habitat which represent the areas that already meet relevant habitat criteria of the associated MU. Consideration of emerging habitat reduces the overall habitat quality score for each MU as by definition, it provides marginal habitat to the species at the time of survey. As a result, there is opportunity for conservation gain throughout multiple attributes including shelter and breeding, mobility, absence of threats and species stocking rate (refer **Table 7.22**).

The further analysis of the sub-attributes is presented in **Table 7.23** below and demonstrates the opportunity for HQS improvement within the threat and secondly, shelter and breeding microhabitat sub-attributes. The former suggests there are active threats present in the proposed offset areas, impacting habitat quality for the species, and that targeted offset interventions will improve the habitat quality and related score for the matter. The latter suggests that breeding features may be the limiting feature for the species to distribute and shelter in otherwise suitable habitat within the offset.

Table 7.22 Summary of the Key Habitat Quality Offset Scores for yellow-bellied glider (south-eastern) within the Offset Areas

Matter unit MU	HQS	HQS Component	Attribute	Scores		
				Average	Max	Difference
Yellow-bellied glider (south-eastern) – Foraging and dispersal	5.6	Site condition	Quality and Availability of Food and Habitat Required for Foraging	7.7	10	2.3
			Quality and Availability of Habitat Required for Shelter and Breeding	3.4	10	**6.6**

Matter unit MU	HQS	HQS Component	Attribute	Scores		
				Average	Max	Difference
		Site context	Quality and Availability of Habitat Required for Mobility	5.4	10	**4.6**
			Absence of Threats	2.8	15	**12.2**
		Species stocking rate (all attributes)		36.7	70	**33.4**
Yellow-bellied glider (south-eastern) – Breeding and denning	6.2	Site condition	Quality and Availability of Food and Habitat Required for Foraging	8.3	10	4.9
			Quality and Availability of Habitat Required for Shelter and Breeding	3.7	10	**14.2**
		Site context	Quality and Availability of Habitat Required for Mobility	5.4	10	**11.3**
			Absence of Threats	2.9	15	**20.8**
		Species stocking rate (all attributes)		39.2	70	**30.8**

Table 7.23 Summary of the Species Specific Sub-Attribute Results within the Offset Area

Attribute	Sub-Attribute	Foraging and Dispersal			Breeding and Denning		
		Avg.	Max	Diff	Avg.	Max	Diff
Quality and Availability of Food and Habitat Required for Foraging	Floral diversity in EDL	7.8	10	2.2	8.3	10	1.7
Quality and Availability of Habitat Required for Shelter and Breeding	Presence of live trees (i.e. stags excluded) bearing at least one hollow >10 cm in diameter	1.4	5	**3.6**	1.9	5	**3.1**
	Presence of large (> 50 cm DBH) smooth bark or half-bark eucalypt species likely to bear hollows in the immediate future	1.8	5	**3.2**	1.8	5	**3.2**
Quality and Availability of Habitat Required for Mobility	Presence of tall trees (median canopy height relative to BioCondition benchmark)	3.5	5	1.5	3.2	5	1.8
	Size of habitat patch (all utilisation types combined). Connecting patches are only considered if completely connected - i.e. no fragmentation.	1.9	5	2.1	2.1	5	**2.9**
Threats	Habitat clearing	3.5	15	**11.5**	3.8	15	**11.2**
	Wildfire damage	5.3	15	**10.7**	4.6	15	**10.4**
	Feral animal predation and/or control	6.0	15	**9**	6.0	15	**9**

Species Stocking Rate

A summary of species stocking rate scoring is provided within **Table 7.24**. The results of the targeted field surveys have concentrations of individuals, in an otherwise patchy distribution. This is evident in the species usage scores, ranging from 2.5 for emerging habitat to 15 for breeding and denning habitat.

Table 7.24 identifies scoring attributes with potential for further improvement (grey cells). In summary, improvements to the species stocking rate score are anticipated to both species usage within foraging and dispersal and approximate density within both management units. These scores will improve as vegetation regenerates and develops more of the species-specific microhabitat features key to foraging, shelter and breeding and mobility.

Table 7.24 Summary of the Results of the Species Stocking Rate Sub-Attributes throughout the Offset Area

SSR Attribute	Details/ Sub-Attribute	Foraging and Dispersal			Breeding and denning		
		Avg.	Max	Diff	Avg.	Max	Diff
Presence detected on or adjacent to site	Detection within assessment unit, study area Detection within matter unit, Study Area / Offset Property or adjacent	5	10	5	6.5	10	3.5
Species usage of the site	Habitat mapping type	6.5	15	**8.5**	11.4	15	3.6
Approximate density	Inferred, based on various metrics including carrying capacity potential. As per **Section 5.4.2**.	14.0	30	**16**	16.3	30	**13.7**
Role/ importance of species population on site – Supplementary SSR table	Key source for population breeding	0	10	10	0	10	10
	Key source population for dispersal	5	5	5	5	5	5
	Necessary for maintaining genetic diversity	0	15	15	0	15	15
	Near the limit of the species range	0	15	15	0	15	15

7.3.5.4 Threats

A summary of each threat is provided below including the metrics which the scores are derived from. There are several threats present in the proposed offset areas that all contribute to a reduction in habitat quality for the species. As such, if management actions are employed for a single threat, such as habitat clearing, and not others, such as managing wildfire or feral animal predation, the overall threat score may not increase significantly. Therefore, an integrated offset management approach that includes the consideration and active management of a range of threats is needed.

- **Habitat Clearing**: calculated at a monitoring site level, with threats immediately possible through legal securement as Category A restricted vegetation under the VM Act. Offset area management plans will prevent the ongoing impact of selective logging and regrowth management. Across the offset areas, habitat clearing has comprised over 782.9 ha within a two year period. This is largely due to the unrestricted nature of vegetation (Category X designation).

- **Wildfire Damage**: calculated at a monitoring site level and can be improved with active fire management such as implementing fire regimes consistent with RE guidelines and constructing and maintaining firebreaks or access tracks for emergency response personnel.

- **Feral Animal Predation and/or Control:** calculated at a monitoring site level and can be improved if continuous feral animal management and monitoring actions can be implemented throughout the offset areas.

Associated Management Actions

Indicative management actions for the proposed offset area to counteract existing threats are listed below:

- In-perpetuity protection within offset area – legally secured.
    - This elevates the regulatory status of an area to a MSES thus increasing the legal protection of the species' habitat. Moreover, unregulated vegetation clearing within areas mapped as cleared land/ Category X will no longer be permitted allowing the vegetation within these areas to regenerate and improve the structural and compositional values measured within the site condition attributes.

- Species-appropriate bushfire management plan implemented.
    - Both reduces the risk of wildfire-induced habitat degradation by construction and maintaining suitable firebreaks/ emergency access and fuel-reduction burns. Moreover, the implementation of fire regimes consistent with RE guidelines will maintain suitable microhabitat features characteristic of each vegetation community. For example, prevent a very dense subcanopy and/or tall shrub understorey of shrubs which can limit glider paths, potentially inhibit movement and cause the species to traverse on ground more frequently.

- Targeted pest and weed control implemented – targeted dingo / wild dog populations.
    - As the scores indicate, feral animal predation is not expected to be the most prevalent threat for the species considering it is both arboreal and not considered common prey to fox, dog or cats. However, feral animal predation can increase significantly after fire and should therefore be considered within the prescribe fire regime.

- Improvement to vegetation condition – enhanced foraging, shelter and breeding habitat.
    - Cattle grazing is the dominant land-use of the study area and is likely continuing to degrade the native vegetation condition and/or inhibit the regeneration capacity of already highly degraded areas. Therefore, implementing strategies to limit grazing pressure throughout various areas will likely see an improvement of the vegetation condition reflected within the site condition attributes. This will have the greatest impact on the emerging foraging and dispersal MU which only contains very young emerging regrowth to moderately mature regrowth vegetation.

- Enhanced landscape connectivity – prioritisation of regrowth woodlands for offset areas.
    - Improves the carrying capacity of both the highly degraded areas which do not currently provide habitat and improves the value of current habitat by increasing connectivity and overall foraging, breeding and/ or dispersal resources.

7.3.5.5 Offset Assessment Guide Calculations

Offset assessment guide inputs relevant to yellow-bellied glider (south-eastern) are provided in **Table 7.25**.

Table 7.25 OAG Inputs for Yellow-bellied glider (south-eastern)

Parameter	Input	Justification
EPBC Act Status	Vulnerable	Effective 2 March 2022
Annual probability of extinction	0.2 %	As per OAG
Impact Calculator		
Area of habitat	322 ha	As detailed in Attachment B4 (Assessment of Matters of National Environmental Significance).
Quality	6	Recorded across 8 habitat quality site assessments and completed in accordance with the methodology described in this Offset Management Strategy. The methodology incorporates site condition, context and species stocking rates, as per DCCEEWs How to Use the Offset Assessment Guide.
Total quantum of impact	193.2 ha	Based on the area of habitat multiplied by the impact quality score (as a proportion out of 10).
Offset Calculator		
Time over which loss is averted (max 20 years)	20 years	Duration of the risk mitigation actions to be taken, or 20 years, whichever is shorter.
Time until ecological benefit	20 years	The estimated time for habitat quality improvement outcomes. A conservative estimate of 20 years has been used, which captures shorter-term benefits associated with certain management strategies, as well as some of the longer-term benefits which would start to become evident by that time, i.e., weed control or vegetation improvement. This parameter will be updated following selection of the offset area and will reflect the management requirements associated with each offset value.
Start area (hectares)	1062.9 ha (100% acquittal)	The total proposed offset area required to acquit 100 % of the land-based offset is 1062.9 ha, with consideration of other metrics outlined in this OAG. The total area of yellow-bellied glider (south-eastern) habitat mapped within the offset properties is 10,482.9 ha (~986 % of offset area required).
Start quality (scale of 0–10)	6	Starting habitat quality score of 6 as area-weighted across two matter units including foraging and dispersal (66%) and breeding and denning (34%). Recorded across 24 habitat quality site assessments completed across proposed offset sites, F1, F2 and F3, in accordance with the methodology described in this Offset Management Strategy. The methodology incorporates site condition, context and species stocking rates, as per DCCEEWs How to Use the Offset Assessment Guide.

Parameter	Input	Justification
Future quality without offset	-1	Without the offset, future habitat quality for the yellow-bellied glider (south-eastern) is conservatively assumed to decline by 1-point. This decline is anticipated based on the combination of known and active threats within the proposed offset areas, including: • Selective clearing. • Inappropriate fire regimes. • Cattle grazing. The selective clearing of canopy tree species occurs in proposed offset areas and is anticipated to continue without the offset. The yellow-bellied glider (south-eastern) requires a diverse floristic composition of canopy species for foraging and large hollow bearing trees for denning (with a preference for very large trees with a DBH >1 m) (DAWE 2022c). The loss or degradation of habitat, particularly loss of hollow bearing canopy species, species diversity or sap foraging trees, are the more significant threats to the yellow-bellied glider (south-eastern) (DAWE 2022c). Selective clearing of canopy tree species will result in a direct reduction of canopy tree species richness, canopy cover and hollows reducing habitat quality for the yellow-bellied glider (south-eastern) (DAWE 2022c). Larger hollow-bearing trees take hundreds of years to develop into a habitat tree for the species (DAWE 2022c), These larger trees are therefore subsequently rare throughout the landscape and have higher value per tree. As such, the loss of one of these large trees has a much larger degree of impact to habitat quality for the yellow-bellied glider (south-eastern). The reduction in canopy species richness and canopy cover as hollow bearing/large trees are selectively removed before they have the chance to fully re-establish, will result in a cumulative decline and therefore reduce the availability and quality of habitat for the yellow-bellied glider (south-eastern). Cattle grazing reduces the successful recruitment of Eucalyptus species, reducing the species richness, quality and availability of food and foraging habitat as well as shelter habitat in the long term for yellow-bellied glider (south-eastern) (DAWE 2022c). Without the management plans of cattle grazing restrictions or reductions from areas, uninhibited cattle grazing is likely to contribute to the culminating decrease of foraging and shelter habitat for the yellow-bellied glider (south-eastern). Inappropriate planned burn regimes and management of fuel loads leads to increased bushfire impact risk to the yellow-bellied glider (south-eastern), including loss of canopy species, foraging species richness and therefore a reduction in quality and available of foraging and shelter habitat (DAWE 2022c). Without the establishment of the proposed Bushfire Management Plan for the proposed offset areas that considers species-specific requirements, the yellow-bellied glider (south-eastern) species stocking rate and habitat condition in the proposed offset areas are at risk of further decline or loss from bushfires (DAWE 2022c).

Parameter	Input	Justification
		The cumulation of threats as evidenced within the proposed offset areas and the broader region, including those outlined above, are reasonably anticipated to result in ongoing decline in habitat quality for the yellow-bellied glider (south-eastern). Components of site condition, site context and species stocking rate, such as, presence and abundance of hollow bearing trees, canopy cover, species richness and quality and availability of foraging and shelter habitat will continue to decline without the offset.
Future quality with offset	+1	Future habitat quality is conservatively predicted to increase by a single point across the proposed offset area. This reflects more significant improvements in smaller areas of degraded habitat and more minor improvements likely to be seen in moderate to high quality habitat. It also reflects the active, property-level management of threats across the proposed offset area. As shown within **Section 7.3.5.2**, analysis of the results from the 24 habitat quality assessments have highlighted sub-attributes within the site condition, site context and SSR components: Site condition: • Abundance of hollow bearing live trees. • Abundance of large, forage/shelter trees. Site context: • Size of habitat patch. • Threat management including legal procurement of current and future habitat and prevention of feral animal control, legal procurement and reclassification of unregulated vegetation to prevent selective logging and habitat clearing and suitable fire management consistent with species' requirements. Species stocking rate: • Improved species usage as hollows develop within foraging and dispersal habitat and is reclassified as breeding and denning habitat. • Additional detections of the species throughout the offset area will increase presence detected.
Confidence in result (%) – HQ	90%	24 habitat quality assessments have been completed across proposed offset sites, F1, F2 and F3. These sites have informed required management actions to lift site condition, context and stocking rate. Further effort to map and characterise population density may also increase the stocking rate scoring.

Parameter	Input	Justification
Risk of loss (%) without offset	2.04 %	The offset areas support large areas of vegetation not currently regulated by the Queensland VM Act. These areas, particularly regrowth, are often subjected to regular, periodic or infrequent clearing. In the case of the proposed offset areas (F1, F2, F3 in particular), mapped yellow-bellied glider (south-eastern) habitat comprising 3,345 ha is currently unregulated (32 % of total yellow-bellied glider (south-eastern) habitat). Observations made by Umwelt (since 2020–2023) have recorded this land management process, resulting in the loss of suitable MNES habitat (including emergent habitat types). The removal of habitat recorded during a 2 year period (782.9 ha) equates to a 2.04 % risk of loss without offset. It is noted that average background clearing rate for Rockhampton (0.69%) and Banana Shire (0.08%) (Maseyk et al. 2017) has been considered in conjunction with the habitat loss observed. This reflects an informed region and local area specific measure of risk of loss, which is considered to be the best available information to inform the offset area calculations.
Risk of loss (%) with offset	0%	With the offset, the risk of loss is reduced to nil, by protecting the offset site through a legal mechanism. Risk of loss is not intended to reflect extreme and random loss events and, as such this is not reflected here. However it is noted that management measures will further reduce threats to the offset site.
Confidence in result (%) – ROL	90%	The confidence in a result reflects the conservative approach that has been taken regarding RoL metrics, which incorporate background clearing rates as per Maseyk et al. (2017), and a measured local RoL reduction in vegetation / habitat across a 2 year period.

7.3.5.6 Summary

The proposed offset areas support habitat for the yellow-bellied glider (south-eastern), commensurate with the impact area habitat and comprising breeding and denning, as well as foraging and dispersal habitat. These areas also provide opportunities for conservation gains as per the Offset Policy. This has been determined through extensive field surveys, using an approach consistent with that used in the impact area.

Using the anticipated OAG inputs, the offset area requirement for 100% acquittal for the yellow-bellied glider (south-eastern) is anticipated to be 1,062.9 ha. Using field verified knowledge of the offset areas, the proposed properties are able to deliver the required offset area and achieve a suitable conservation gain for the species, as well as halting further decline and degradation.

The identification of existing threats to the species and indicative management actions will support the development of an OAMP. The OAMP will be developed after additional survey effort and further examination of offset properties. In a finalised OAMP, it is anticipated a single property or a blend of suitable habitat from several properties will enable an overall environmental improvement and counterbalance the impact to yellow-bellied glider (south-eastern).

The proposed offset areas are able to provide a direct, land-based, like-for-like offset for the species and are capable of fully acquitting the Project Significant Residual Impact to yellow-bellied glider (south-eastern) habitat. As such, offsets on the identified properties are suitable, appropriate, and feasible, and able to be delivered in accordance with the Offset Policy.

7.3.6 Koala

7.3.6.1 Species Presence and Habitat Availability

As shown in **Table 7.26** below, a single pair of adult and joey koalas were recorded during field surveys within property F3. There are very few other records in the region, all either beyond 20 km or historical records no longer connected via habitat corridors. Impacted habitat and potential offset habitat has been delineated into two types, climate refugia, as well as breeding, foraging and dispersal habitat. These habitat types were confirmed from each of the offset properties, with potential offset habitat areas commensurate with impacted habitat types.

Table 7.26 Koala Presence and Habitat Availability

Attribute	Justification or Type	Offset Property				
		R1	R2	F1	F2	F3
Presence (record)	Known record, including desktop records	No	No	No	No	Yes
Contiguous with record(s)	Mapped corridors or contiguous habitat with species records	No	No	No	No	No
Habitat	Habitat not delineated –rapid and baseline field survey, in conjunction with desk based extrapolation of state habitat mapping layers only	53.3 ha	2,175.4 ha	N/A	N/a	N/a

Attribute	Justification or Type	Offset Property				
		R1	R2	F1	F2	F3
Habitat Type	Climate refugia	Known	Known	92.4 ha	206.9 ha	42.0 ha
	Breeding, foraging and dispersal	Known	Known	4,658.3 ha	7,644.0 ha	4,231.3 ha

7.3.6.2 Habitat Quality Assessment

Koala habitat was separated into two matter units:

1. climate refugia (CR)
2. breeding, foraging and dispersal habitat (BFD).

Furthermore, each MU was split into assessment units based on the conditional state of the vegetation which included, emerging (breeding, foraging and dispersal only), regrowth or remnant conditions as verified during field surveys.

The area-weighted habitat quality score (HQS) for both matter units, including the summary of site condition (Cnd), site context (Cxt) and species stocking rate (SSR) scores are presented in **Table 7.27** below. The single area-weighted HQS of 6.9 for CR and 6.9 for breeding, foraging and dispersal (**Table 7.27**) represent koala habitat quality throughout the range of condition states within each MU for the species.

Table 7.27 Koala Habitat Quality Assessment

Species	Matter Unit/ Habitat Utilisation	Impact				Offset			
		Cnd	Cxt	SSR	HQS	Cnd	Cxt	SSR	HQS
Maximum score		**3**	**3**	**4**	**10**	**3**	**3**	**4**	**10**
Koala	Climate refugia	1.9	2.1	2.6	**6.8**	2.0	2.2	2.6	**6.9**
	Breeding, foraging and dispersal	2.3	2.0	2.6	**7.0**	2.1	2.2	2.3	**6.7**

7.3.6.3 Conservation Gain

The proposed offset areas provide opportunities for conservation gain described in the Offset Policy, in particular 'improving existing habitat for the protected matter'. Some of the key species-specific attributes scored within the MHQA are presented in **Table 7.28** below. The scoring shows that absence of threats was the lowest scoring attribute type at an average of 3.5/15 for Koala BFD and 3.1/15 for Koala CR. In contrast, the foraging habitat, shelter and breeding habitat and mobility is in fairly good quality ranging from 7.7 to 9.8. This demonstrates that there are active threats present in the proposed offset areas, impacting habitat quality for the species, and that targeted offset interventions are needed. Additionally, the species has only been recorded once throughout study area and the species stocking rate score is low. There is likely an interplay between the level of threats on site and the presence and density of koalas, which would be expected to increase as habitat quality improves. In addition to the key species-specific threats shown below, the overall site condition is anticipated to increase.

A further analysis of the sub-attributes is presented below in **Table 7.28** and emphasises the lagging effect the threat attributes are having on the HQS for both koala MUs. Further habitat growth (large trees as shelter) is also represented in the scoring below.

Table 7.28 Summary of the Key Habitat Quality Offset Scores for koala throughout the Offset Area

Matter unit	MU	HQS	HQ Component	Attribute	Scores (Area Weighted)		
					Average	Max	Difference
Koala – Breeding, foraging and dispersal	BFD	6.0	Site condition	Quality and Availability of Food and Habitat Required for Foraging	8.6	10	1.4
				Quality and Availability of Habitat Required for Shelter and Breeding	7.7	10	2.3
			Site context	Quality and Availability of Habitat Required for Mobility	9.8	10	0.2
				Absence of Threats	3.5	15	**11.5**
			Species stocking rate (all attributes)		31.3	70	**45.4**
Koala – Climate refugia	CR	6.3	Site condition	Quality and Availability of Food and Habitat Required for Foraging	8.0	10	2.0
				Quality and Availability of Habitat Required for Shelter and Breeding	7.0	10	3.0
			Site context	Quality and Availability of Habitat Required for Mobility	9.9	10	0.1
				Absence of Threats	3.0	15	**12**
			Species stocking rate (all attributes)		35.9	70	**50.9**

Table 7.29 Summary of the Species Specific Sub-Attribute Results (as per MHQA)

Attribute	Sub-Attribute	Breeding, Foraging and Dispersal			Climate Refugia		
		Avg.	Max	Diff	Avg.	Max	Diff
Quality and Availability of Food and Habitat Required for Foraging	Presence of preferred food tree species	4.3	5	0.7	1.5	5	3.5
	Size of habitat patch	4.1	5	0.9	2.0	5	3.0
Quality and Availability of Habitat Required for Shelter and Breeding	Presence of shelter trees i.e. large trees (as per benchmark)	2.8	5	2.2	0.5	5	4.5
	Presence of refugia (e.g., drainage lines, riparian zones, patches with favourable hydrological systems)	5.0	5	0.0	5.0	5	0.0
Quality and Availability of Habitat Required for Mobility	Habitat patch connectivity	7.5	7.5	0.0	7.5	7.5	0.0
	Presence of nearby vegetated watercourses	2.4	2.5	0.1	2.0	2.5	0.5
Threats	Habitat clearing	5.1	15	**9.9**	5	15	**10.0**
	Wildfire damage	5.7	15	**9.3**	3.75	15	**11.3**
	Feral animal predation and/or control	5.0	15	**10.0**	5	15	**10.0**

** All scores comprise averaged scores, rather than area-weighted averaged.*

Species Stocking Rate

A summary of species stocking rate scoring is provided, and within **Table 7.30**. A single pair of adult and joey koalas were detected within the study area indicating a low population density. Therefore, the species was assigned partial score of 5 for presence detected and genetic diversity sub-attributes within the species stocking rate supplementary table pertaining to the role/ importance of species population. The matter scored higher for approximate density as this score is inferred by carrying capacity potential (**Section 5.4.2.1**). In addition, species usage of the site is determined by the habitat mapping type that each monitoring site is located within and secondly, whether the habitat is connected to climate refugia such as riparian corridors.

Table 7.30 Summary of the Results of the Species Stocking Rate Sub-Attributes throughout the Offset Area

SSR Attribute	Details/ Sub-Attribute	Breeding, Foraging and Dispersal			Climate Refugia		
		Avg.	Max	Diff	Avg.	Max	Diff
Presence detected on or adjacent to site	Detection within matter unit, Study Area / Offset Property or adjacent	5	10	5	5	10	5
Species usage of the site	Habitat mapping type and proximity to refugia	9.3	15	5.7	15	15	0
Approximate density	Inferred, based on various metrics including carrying capacity potential. As per **Section 5.4.2**.	22.0	30	8	20.9	30	9.1
Role/ importance of species population on site – Supplementary SSR table	Key source for population breeding	10	10	15	10	10	15
	Key source population for dispersal	5	5	15	5	5	15
	Necessary for maintaining genetic diversity	5	15	15	5	15	15
	Near the limit of the species range	0	15	15	0	15	15

Table 7.30 identifies scoring attributes with potential for further improvement (grey cells). In summary, the following outcomes will improve the species stocking rate score:

- Increased detections of the species throughout the proposed offset area.
- Being within a state recognised ecological corridor, increased koala population throughout the site would have broader positive impacts at the landscape and regional-scale for the species. This would result in an increased score for role/ importance of species population, notably scoring metrics for key source for population breeding and key source for population dispersal sub-attributes.
- Improvement of the species usage can result from two outcomes. Firstly, the improvement of vegetation condition and regeneration from cleared land to regrowth and remnant which will result in the reclassification of habitat patches from emerging breeding, foraging and dispersal habitat to breeding foraging and dispersal. Secondly, improvement in connectivity between refugia and breeding, foraging and dispersal habitat.

7.3.6.4 Threats

A summary of key threats recorded within each offset area is provided below. There are several threats present in the proposed offset areas that all contribute to a reduction in habitat quality for the species. As such, if management actions are employed for a single threat, such as habitat clearing, and not others, such as managing wildfire or feral animal predation, the overall threat score may not increase significantly. Therefore, an integrated offset management approach that includes the consideration and active management of a range of threats is needed.

- **Habitat Clearing**: calculated at a monitoring site level, with threats immediately possible through legal securement as Category A restricted vegetation under the VM Act. Offset area management plans will prevent the ongoing impact of selective logging and regrowth management. Across the offset areas, habitat clearing has comprised over 782.9 ha within a two year period. This is largely due to the unrestricted nature of vegetation (Category X designation).

- **Wildfire Damage**: calculated at a monitoring site level and can be improved with active fire management such as implementing fire regimes consistent with vegetation community guidelines, construction and maintaining of firebreaks, as well as access tracks for emergency response personnel.

- **Feral Animal Predation and/or Control:** calculated at a monitoring site level and can be improved if continuous feral animal management and monitoring actions are implemented throughout the offset areas.

Associated Management Actions

Indicative management actions for the proposed offset area to counteract existing threats are listed below:

- In-perpetuity protection within offset area – legally secured.
    - This elevates the regulatory status of an area to a MSES thus increasing the legal protection of the species' habitat. Moreover, unregulated vegetation clearing within areas mapped as cleared land/ Category X will no longer be permitted allowing the vegetation within these sites to regenerate and provide the structural and compositional values measured within the site condition attributes.

- Species-appropriate bushfire management plan implemented.
    - Both reduces the risk of wildfire-induced habitat degradation by construction and maintaining suitable firebreaks/ emergency access and fuel-reduction burns. Moreover, the implementation of fire regimes consistent with relevant vegetation community guidelines will maintain suitable microhabitat features characteristic of each vegetation community. For example, prevent a very dense understorey of shrubs which can inhibit koala movement.

- Targeted pest and weed control implemented.
    - Results of targeted field surveys to date suggest avery low population of koala throughout both the impact and offset areas. The management of feral animal presence and potential koala predation will enhance habitat quality for the species and provide greater opportunity for the species to disperse through the offset areas. The targeted treatment of existing weed barriers, such as *Lantana camara*, will facilitate improved movement opportunities and increase the overall health and condition of koala habitat (i.e. reduced suppression of feed trees and management of bushfire risk).

- Improvement to vegetation condition – enhanced foraging, shelter and breeding habitat.
    - Cattle grazing is the dominant land-use of the study area and is continuing to degrade the native vegetation condition and/or inhibit the regeneration capacity of already highly degraded areas. Therefore, implementing strategies to limit grazing pressure throughout various areas will see an improvement of the vegetation condition reflected within the site condition attributes.
- Enhanced landscape connectivity – prioritisation of regrowth woodlands and emerging habitat areas for offset areas.
    - Improves the carrying capacity of both the highly degraded areas which currently provide limited habitat and the value of current habitat by increasing foraging, breeding and/ or dispersal resources.

7.3.6.5 Offset Assessment Guide Calculations

Offset assessment guide inputs relevant to koala are provided in **Table 7.31** below.

Table 7.31 OAG Inputs for Koala

Parameter	Input	Justification
EPBC Act Status	Endangered	Effective date 12 February 2022
Annual probability of extinction	1.2 %	As per OAG
Impact Calculator		
Area of habitat	646.9	As detailed in Attachment B4 (Assessment of Matters of National Environmental Significance).
Quality	7	Starting habitat quality score of 6 as area-weighted across two matter units including breeding, foraging and dispersal (97%) and climate refuge (3%). Recorded across 19 modified habitat quality site assessments, in accordance with the methodology described in this Offset Management Strategy (refer **Section 5.0**). The methodology incorporates site condition, context and species stocking rates, as per DCCEEWs *How to Use the Offset Assessment Guide*.
Total quantum of impact	452.8	Based on the area of habitat multiplied by the impact quality score (as a proportion out of 10).
Offset Calculator		
Time over which loss is averted (max 20 years)	20 years	Duration of the risk mitigation actions to be taken, or 20 years, whichever is shorter.
Time until ecological benefit	20 years	The estimated time for habitat quality improvement outcomes. A conservative estimate of 20 years has been used, which captures shorter-term benefits associated with certain management strategies, as well as some of the longer-term benefits which would start to become evident by that time, i.e., weed control or vegetation improvement. This parameter will be updated following selection of the offset area and will reflect the management requirements associated with each offset value.
Start area (hectares)	3,009.5 ha (100% acquittal) 19,103.6 ha (total available)	The total proposed offset area required to acquit 100 % of the land-based offset is 3,009.5 ha, with consideration of other metrics outlined in this OAG. The total area of koala habitat mapped within the offset properties is 19,103.6 ha (~634 % of offset area required).
Start quality (scale of 0–10)	7	Recorded across 59 modified habitat quality site assessments completed across proposed offset sites, F1, F2 and F3, in accordance with the methodology described in this Offset Management Strategy (**Section 5.0**). The methodology incorporates site condition, context and species stocking rates, as per DCCEEWs *How to Use the Offset Assessment Guide*.

Parameter	Input	Justification
Future quality without offset	-1	Without the offset, future habitat quality for the koala is conservatively assumed to decline by 1-point. This decline is anticipated based on the combination of a known and active threats within the proposed offset areas, including: • Invasive flora. • Invasive fauna. • Habitat clearing. • Bushfire / wildfire. With regard to invasive flora, *Lantana camara, Cryptostegia grandiflora, Opuntia tomentosa, Opuntia stricta, Passiflora suberosa, Passiflora subpeltata* and at least 20 other weed species have been field verified in the proposed offset areas. The average cover of weeds across all habitat quality assessment sites is 19.5 %. High levels of weed cover within the proposed offset areas predominately comprised of *Lantana camara* and *Cryptostegia grandiflora*. These species are recognised threats to the koala and are known to act as a barrier to movement, particularly where weed cover is dense and within riparian movement corridors (e.g. mapped koala climate refugia habitat) as observed in the proposed offset areas (DAWE 2022a and DAWE 2022b). It is acknowledged that in Queensland, the *Biosecurity Act 2014* requires landowners to manage restricted weeds species, of which *Lantana camara* and *Cryptostegia grandiflora* are listed as Category 3 species under the Act. Despite this requirement, as evidenced by the habitat quality assessments completed across the proposed offset areas, these restricted weeds are established and are not being effectively managed, nor targeted for threatened species outcomes such as within riparian movement corridors (mapped koala climate refugia habitat). Without effective weed management, the proposed offset areas condition is anticipated to degrade as weed cover increases, or further establishes in areas not currently infested or where weed cover is currently low. It is anticipated the further advancement of *Lantana camara* and *Cryptostegia grandiflora* would actively contribute toward a decline in species mobility capacity, with the koala known to be unwilling to cross dense patches of *Lantana camara* or *Cryptostegia grandifl*ora (DAWE 2022a and DAWE 2022b). Several exotic fauna species are known to occur in the proposed offset areas, confirmed during field surveys. Wild dog/dingo is a known predator to koala, recorded throughout the proposed offset areas and known to the surrounding region, including connective habitat and associated movement corridors which intersect the proposed offset areas. Predation from pest species, namely dogs and foxes are a major threat to the koala (DAWE 2022a and DAWE 2022b). Introduced predators are likely to continue to influence the species stocking rate and present an ongoing threat to any local koala populations. In the absence of tailored pest monitoring and management as part of offset delivery, introduced predator populations will continue to thrive and contribute to the cumulative decline in habitat quality as a known threat to the koala.

Parameter	Input	Justification
		The selective clearing of canopy tree species and/or clearing of discrete patches of regrowth habitat occurs in the proposed offset areas and is anticipated to continue without the legal securement that an offset provides. The loss or degradation of habitat, particularly recognised canopy species as koala food trees, is one of the more significant threats to the koala (DAWE 2022a and DAWE 2022b). This selective clearing of canopy tree species will impart a direct reduction on canopy cover and reduce the overall foraging resources available for the koala (DAWE 2022a and DAWE 2022b; Schlagloth et al. 2023). The reduction in canopy cover, as large trees are selectively removed before they have the chance to fully re-establish, will result in a cumulative decline and therefore reduce the availability and quality of habitat for the koala. Additionally, in Queensland, under Schedule 21 of the Planning Regulation 2017, landowners can clear vegetation mapped as Category X (non-remnant) on the regulated vegetation map for agricultural purposes. While these areas could regenerate between clearing events, they are usually managed as cleared land for agricultural purposes, as observed within the proposed offset areas. Given the above, the selective clearing of canopy trees and ongoing management of mapped Category X vegetation, is reasonably anticipated to continue and contribute to a cumulative decline in habitat quality for the koala. Koala populations across parts of Queensland and NSW were significantly impacted by the 2019–2020 bushfires (Beale et al. 2022). Inappropriate planned burn regimes and management of fuel loads leads to increased bushfire impact risk to the koala. Without the establishment of the proposed Bushfire Management Plan for the offset, the koala habitat condition in the proposed offset areas are at risk of further degradation or loss from bushfires. The cumulation of threats as evidenced within the proposed offset areas and the broader region, including those outlined above, are reasonably anticipated to result in further decline in habitat quality for the koala. Components of site condition, site context and species stocking rate, such as weed cover, canopy cover, mobility capacity, and density will continue to decline without the offset.
Future quality with offset	+1	A total of 59 habitat quality assessments have been completed across proposed offset sites, F1, F2 and F3 to provide a indicative range of habitat quality throughout the offset properties. The data of which has been interrogated to determine potential future overall habitat quality of the offset. Future habitat quality is conservatively predicted to increase by a single point across the proposed offset area. This reflects more significant improvements in smaller areas of degraded habitat and more minor improvements likely to be seen in moderate to high quality habitat. It also reflects the active, property-level management of threats across the proposed offset area. The managed recovery over a 20 year timeframe of emergent habitat is anticipated to increase foraging and dispersal habitat for the species, as well as increase connectivity throughout the offset area. **Section 7.3.6.3** presents an analysis of the HQS results highlighting opportunities to improve habitat quality and achieve a conservation gain. In particular, management of the following attributes will result in the greatest habitat quality gain:

Parameter	Input	Justification
		Site condition: • Abundance of large, shelter trees. Site context: • Threat management including legal procurement of current and future habitat and prevention of feral animal control, habitat clearing and suitable fire management consistent with species' requirements. Species stocking rate: • Improved species usage as connectivity between breeding, foraging and dispersal habitat and hydrological refugia increases.
Confidence in result (%) – HQ	90%	A relatively high confidence in the habitat quality result is provided, noting the existing status of habitat available as either remnant or regrowth. The management actions required to secure and then manage the offset areas are: • well established measures • build on and improve largely existing habitat • are not reliant on novel or uncertain restoration techniques • avoid approaches that would carry higher risk of delivery.
Risk of loss (%) without offset	2.04%	The offset areas support large areas of vegetation not currently regulated by the Queensland VM Act. These areas, particularly regrowth, are often subjected to regular, periodic or infrequent clearing. In the case of the proposed offset areas (F1, F2, F3 in particular), mapped koala habitat comprising 10,824 ha is currently unregulated (64% of total koala habitat). Observations made by Umwelt (since 2020–2023) have recorded this land management process, resulting in the loss of koala habitat (including emergent habitat types). The removal of habitat recorded during a 2 year period (782.9 ha) equates to a 2.04 % risk of loss without offset. It is noted that average background clearing rate for Rockhampton (0.69%) and Banana Shire (0.08%) (Maseyk et al. 2017) has been considered in conjunction with the habitat loss observed. This reflects an informed region and local area specific measure of risk of loss, which is considered to be the best available information to inform the offset area calculations.
Risk of loss (%) with offset	0%	With the offset, the risk of loss is reduced to nil, by protecting the offset site through a legal mechanism. Risk of loss is not intended to reflect extreme and random loss events and, as such this is not reflected here. However, it is noted that management measures will further reduce threats to the offset site.
Confidence in result (%) – ROL	90%	The confidence in a result reflects the conservative approach that has been taken regarding RoL metrics, which incorporate background clearing rates as per Maseyk et al. (2017), and a measured local RoL reduction in vegetation / habitat across a 2 year period.

7.3.6.6 Summary

The proposed offset areas support habitat for the koala, commensurate with the impact area habitat, including both climate refuge and breeding, foraging and dispersal habitat. These areas also provide opportunities for conservation gains as per the Offset Policy. This has been determined through extensive field surveys, using an approach consistent with that used in the impact area.

Using the anticipated OAG inputs as described above, the offset area requirement for 100% acquittal for the koala is anticipated to be 3,009.5 ha. Using field verified knowledge of the offset areas, the proposed properties are able to deliver the required offset area and achieve a suitable conservation gain for the species, as well as halting further decline and degradation.

The identification of existing threats to the species and indicative management actions will support the development of an OAMP. The OAMP will be developed after additional survey effort and further examination of offset properties. In a finalised OAMP, it is anticipated a single property or a blend of suitable habitat from several properties will enable an overall environmental improvement and counterbalance the impact to koala.

The proposed offset areas are able to provide a direct, land-based, like-for-like offset for the species and are capable of fully acquitting the Project Significant Residual Impact to koala habitat. As such, offsets on the identified properties are suitable, appropriate, and feasible, and able to be delivered in accordance with the Offset Policy.

7.3.7 Collared Delma

7.3.7.1 Species Presence and Habitat Availability

As shown in **Table 7.32** below, the collared delma is not known to the Study Area or the proposed offset properties. There are very few recent or reliable records in the region. This includes one record within the southern portion of the Study Area, however spatial inaccuracy is 100 km. More recent records are associated with Kroombit Tops National Park, 60 km south of the impact area. Due to the sedentary nature of the species, impacted habitat and potential offset habitat not been delineated beyond breeding, foraging and dispersal habitat. Potential habitat within the offset properties was commensurate with the impact site.

Table 7.32 Collared Delma Presence and Habitat Availability

Attribute	Justification or Type	Offset Property				
		R1	R2	F1	F2	F3
Presence (record)	Known record, including desktop records	No	No	No	No	No
Contiguous with record(s)	Mapped corridors or contiguous habitat with species records	No	No	No	No	No
Habitat	Rapid and baseline field survey, in conjunction with desk based extrapolation of state habitat mapping layers only.	30.0	2,140.3	N/A	N/a	N/a
Habitat Type	Breeding, foraging and dispersal.	Known	Known	1,617.4	836.6	3,632.8

7.3.7.2 Habitat Quality Assessment

Due to the sedentary nature of the species, collared delma habitat was mapped as a single matter unit: Breeding and Foraging habitat. This MU was delineated into remnant or regrowth assessment units within the impact and offset areas. The area-weighted HQS of 6.6 is presented in **Table 7.33** below and shows the summary of site condition, site context and species stocking rate scores.

Table 7.33 Collared Delma Habitat Quality Assessment

Species	Matter Unit/ Habitat Utilisation	Impact				Offset			
		Cnd	Cxt	SSR	HQS	Cnd	Cxt	SSR	HQS
Maximum score		**3**	**3**	**4**	**10**	**3**	**3**	**4**	**10**
Collared delma	Breeding and foraging	1.8	1.8	2.5	**6.2**	2.0	2.3	2.3	**6.6**

7.3.7.3 Conservation Gain

The species-specific attributes scored within the MHQA are presented in **Table 7.34** below. Habitat mobility attributes are not relevant to the species due to its sedentary nature. Results of the scoring presented in **Table 7.34** shows that absence of threats was the lowest scoring attribute type at an average of 6.3/15. Other attributes scored moderately when compared with the maximum achievable. Thes scoring reflects verified on-ground habitat, with key shelter habitat (surface rocks), in combination with leaf litter, being patchily distributed within suitable vegetation / land zone types.

The further analysis of species-specific sub-attributes is presented below in **Table 7.35** and shows that the threat attributes have the greatest potential for improvement on the HQS. This demonstrates that there are active threats present in the proposed offset areas, impacting habitat quality for the species, and that targeted offset interventions are needed.

Table 7.34 Summary of the Key Habitat Quality Offset Scores for collared delma throughout the Offset

Matter unit	HQS	HQS Component	Attribute	Scores		
				Average	Max	Difference
Collared delma – Breeding and foraging	6.6	Site condition	Quality and Availability of Food and Habitat Required for Foraging	6.4	10	3.6
			Quality and Availability of Habitat Required for Shelter and Breeding	3.3	10	**6.4**
		Site context	Quality and Availability of Habitat Required for Mobility	NA	NA	NA
			Absence of Threats	6.3	15	**8.7**
		Species stocking rate (all attributes)		36.3	62.5	**28.8**

Table 7.35 Summary of the Species Specific Sub-Attribute Results throughout the Offset Area

Attribute	Sub-attribute	Breeding, Foraging and Dispersal Habitat		
		Avg.	Max	Diff
Quality and Availability of Food and Habitat Required for Foraging	Presence of suitable microhabitat for prey species i.e. insects, spiders and cockroaches (organic litter, shedding bark, large logs, woody debris, grass)	6.6	10	3.4
Quality and Availability of Habitat Required for Shelter and Breeding	Surface rocks and/or rock outcrops	0.6	4	5.4
	Mats of leaf litter (30–100 mm)	1.2	3	1.8
	Coarse woody debris	0.5	3	2.5
Threats	Habitat clearing	7.1	15	**7.9**
	Wildfire damage	3.6	15	**11.4**

Species Stocking Rate

A summary of species stocking rate scoring results is provided within **Table 7.36**. The species has not been detected during the targeted field surveys, although is highly cryptic. Given recent records are known to the region, including on similar land zones to the Project, the scoring has resulted in a score of 5 for presence detected. The species usage was limited to a single habitat class due to the sedentary nature of the species scoring the maximum of 7.5. The approximate density score was low, owing to the mid-sparse abundance of foraging, shelter and breeding microhabitat features throughout the proposed offset area. In contrast, the species was attributed a maximum score of 15 for the role/importance of the population as any potential population is situated within a state-recognised ecological corridor toward the northern range of the species' distribution.

Table 7.36 identifies the species stocking rate scoring attributes with potential for further improvement (grey cells). In summary, the detection of the species within an assessment unit and/or the further development of vegetation and associated species-specific habitat quality attributes over time, will improve the species stocking rate score.

Table 7.36 Summary of the Results of the Species Stocking Rate Sub-Attributes throughout the Offset Area

SSR Attribute	Details/ Sub-attribute	Breeding, Foraging and Dispersal Habitat		
		Avg.	Max	Diff
Presence detected on or adjacent to site	Detection within matter unit, Study Area / Offset Property or adjacent	5	10	**5**
Species usage of the site	Monitoring site mapped as habitat	7.5	7.5	0
Approximate density	Inferred, based on various metrics including carrying capacity potential. As per **Section 5.4.2**.	8.8	30	**21.2**
Role/ importance of species population on site	Key source for population breeding	10	10	0
	Key source population for dispersal	5	5	0

SSR Attribute	Details/ Sub-attribute	Breeding, Foraging and Dispersal Habitat		
		Avg.	Max	Diff
– Supplementary SSR table	Necessary for maintaining genetic diversity	15	15	0
	Near the limit of the species range	15	15	0

7.3.7.4 Threats

A summary of key threats recorded within each offset area is provided below. There are several threats present in the proposed offset areas that all contribute to a reduction in habitat quality for the species. As such, if management actions are employed for a single threat, such as habitat clearing, and not others, such as managing wildfire or feral animal predation, the overall threat score may not increase significantly. Therefore, an integrated offset management approach that includes the consideration and active management of a range of threats is needed.

- **Habitat Clearing**: calculated at a monitoring site level, with threats immediately possible through legal securement as Category A restricted vegetation under the VM Act. Offset area management plans will prevent the ongoing impact of selective logging and regrowth management. Across the offset areas, the clearance of vegetation has comprised 782.9 ha within a two year period. This is largely due to the unrestricted nature of vegetation (Category X designation).
- **Wildfire Damage**: calculated at a monitoring site level and can be improved with active fire management such as implementing fire regimes consistent with vegetation community guidelines, construction and maintaining of firebreaks, as well as access tracks for emergency response personnel.

Associated Management Actions

Indicative management actions to counteract existing threats were identified and listed below:

- In-perpetuity protection within offset area – legally secured.
    - This elevates the regulatory status of an area to a MSES thus increasing the legal protection of the species' habitat. Moreover, unregulated vegetation clearing within areas mapped as non-remnant/ Category X will no longer be permitted allowing the vegetation within these sites to regenerate and provide the structural and compositional values measured within the site condition attributes.
- Species appropriate bushfire management plan implemented.
    - Both reduces the risk of wildfire-induced habitat degradation by construction and maintaining suitable firebreaks/ emergency access and fuel-reduction burns. Moreover, the implementation of fire regimes consistent with relevant vegetation community guidelines will maintain suitable microhabitat features characteristic of each vegetation community.
- Targeted pest and weed control implemented.
    - The targeted treatment of existing weed barriers, particularly ground cover species will improve the foraging, shelter and breeding habitat for collared delma.

- Improvement to vegetation condition – enhanced foraging, shelter and breeding habitat.
    - Cattle grazing is the dominant land-use of the study area and is continuing to degrade the native vegetation condition and/or inhibit the regeneration capacity of already highly degraded areas. Therefore, implementing strategies to limit grazing pressure throughout various areas will see an improvement of the vegetation condition reflected within the site condition attributes.
    - Increase abundance of foraging and shelter habitat through the retention and translocation of coarse woody debris litter and rocky scree from the impact area into offset area.
- Enhanced landscape connectivity – prioritisation of regrowth woodlands and emerging habitat areas for offset areas.
    - Reduces the edge effect and associated threats such as weed incursion that further degrades the habitat quality.

7.3.7.5 Offset Assessment Guide Calculations

Offset assessment guide inputs relevant to collared delma are provided in **Table 7.37**.

Table 7.37 OAG Inputs for Collared Delma

Parameter	Input	Justification
EPBC Act Status	Vulnerable	Effective 16 July 2000
Annual probability of extinction	0.2 %	As per OAG
Impact Calculator		
Area of habitat	272.8 ha	As detailed in Attachment B4 (Assessment of Matters of National Environmental Significance).
Quality	6	Recorded across 12 habitat quality site assessments and completed in accordance with the methodology described in this Offset Management Strategy. The methodology incorporates site condition, context and species stocking rates, as per DCCEEWs How to Use the Offset Assessment Guide.
Total quantum of impact	163.68	Based on the area of habitat multiplied by the impact quality score (as a proportion out of 10).
Offset Calculator		
Time over which loss is averted (max 20 years)	20 years	Duration of the risk mitigation actions to be taken, or 20 years, whichever is shorter.
Time until ecological benefit	20 years	The estimated time for habitat quality improvement outcomes. A conservative estimate of 20 years has been used, which captures shorter-term benefits associated with certain management strategies, as well as some of the longer-term benefits which would start to become evident by that time, i.e., weed control or vegetation improvement. This parameter will be updated following selection of the offset area and will reflect the management requirements associated with each offset value.
Start area (hectares)	891.8 ha (100% acquittal)	The total proposed offset area required to acquit 100 % of the land-based offset is 891.8 ha, with consideration of other metrics outlined in this OAG. The total area of collared delma habitat mapped within the offset properties is 8257.1 (925 % of offset area required).
Start quality (scale of 0–10)	7	Recorded across 38 habitat quality site assessments completed across proposed offset sites, F1, F2 and F3, in accordance with the methodology described in this Offset Management Strategy. The methodology incorporates site condition, context and species stocking rates, as per DCCEEWs How to Use the Offset Assessment Guide.

Parameter	Input	Justification
Future quality without offset	-1	Without the offset, future habitat quality for the collared delma is conservatively assumed to decline by 1-point. This decline is anticipated based on the combination of known and active threats within the proposed offset areas, including: • Loss of habitat through selective clearing. • Habitat modification and degradation. • Direct mortality from grazing and clearing. • Inappropriate fire regimes. • Invasive weeds and pests. The collared delma is a small, relatively sedentary, ground dwelling reptile that is highly reliant on suitable microhabitat in exposed rocky outcrops with native grasses (DEWHA 2008, DSEWPaC 2011). While habitat loss through clearing is a threat to the species, habitat modification and the loss of suitable microhabitat substantially reduces habitat quality for the species, even if the canopy is left intact. Therefore, land uses and management activities that impact on these microhabitat features cause a decline in habitat quality. Vegetation clearing (selective or small-scale) decreases the availability of these microhabitat features and presents a risk of mortality during clearing activities (DEWHA 2008, DSEWPaC 2011). The decreased in canopy cover, native grass cover, organic litter, large woody debris and rocky outcrops that typically results from clearing, increases susceptibility to predation from the increased exposure (DEWHA 2008, DSEWPaC 2011). Given the above, selective logging or small-scale clearing of canopy trees and ongoing management of mapped Category X vegetation is reasonably anticipated to continue and contribute to a cumulative decline in habitat quality for the collared delma. Similarly, this species is vulnerable to impacts from grazing, through cattle trampling, soil compaction, loss of habitat complexity and loss of microhabitat features. Without the establishment of cattle grazing controls such as fencing and reduction or removal of cattle in the proposed offset areas, the collared delma is at risk to a direct mortality and a decrease in species stocking rates. The collared delma as a ground-dwelling species is particularly susceptible to impacts from fire due to its localised use of microhabitats and sedentary nature (DEWHA 2008). Planned burns that are too frequent or high intensity bushfires will reduce species stocking rates through mortality as this species will more likely shelter in microhabitats rather than avoid of a fire (DEWHA 2008). These fires will also reduce microhabitat availability through loss of large woody debris and organic litter (DEWHA 2008). Conversely, planned burns that are too infrequent or non-existent lead to the build up of fuel loads and increased bushfire risk (DEWHA 2008). Intense bushfires pose a much higher risk to loss of habitat and mortality of the collared delma, having the potential to lose more microhabitat features and have a greater impact on species stocking rates (DEWHA 2008). No formalised planned burn regime is currently documented for the proposed offset properties. Additionally, the species requires a fire management program that specifically considers the species and its sensitivity to fire, rather than a typical landscape approach. Without the establishment of the proposed Bushfire Management Plan for the offset, the northern quoll habitat condition in the proposed offset areas are at risk of further degradation or loss from bushfires and/or inappropriate planned burn regimes.

Parameter	Input	Justification
		Invasive flora such as *Lantana montevidensis, Lantana camara, Cryptostegia grandiflora, Passiflora suberosa, Passiflora subpeltata* and at least 20 other weed species have been field verified in the proposed offset areas. For example, the average cover of weeds across all Biocondition sample plots is 19.5 %. *Lantana montevidensis* and other groundcover weed species are known to act as a barrier to movement for this species (DEWHA 2008, DSEWPaC 2011). It is acknowledged that in Queensland, the Biosecurity Act 2014 requires landowners to manage restricted weeds species, of which *Lantana montevidensis, Lantana camara* and *Cryptostegia grandiflora* are listed as Category 3 species under the Act. Despite this requirement, as evidenced by the habitat quality assessments completed across the proposed offset areas, these restricted weeds are established (19.5% average cover) and are not being effectively managed, or focussed for threatened species outcomes such as management within or surrounding rocky outcrop microhabitats. Without effective weed management proposed as part of offset delivery the proposed offset areas condition is anticipated to degrade as weed cover increases, or further establishes in areas not currently infested or where weed cover is currently low. It is anticipated the further advancement of *Lantana montevidensis, Lantana camara* and *Cryptostegia grandiflora* would actively contribute toward a decline in species mobility capacity, with the collared delma known to restricted by patches of *Lantana montevidensis* (DEWHA 2008, DSEWPaC 2011). The cumulation of threats as evidenced within the proposed offset areas and the broader region, including those outlined above, are reasonably anticipated to result in ongoing decline in habitat quality for the collared delma. Components of site condition, site context and species stocking rate such as tree and shrub canopy cover, native grass cover, coarse woody debris and quality and availability of foraging and shelter habitat will continue to decline without the offset.
Future quality with offset	+1	Future habitat quality is conservatively predicted to increase by a single point across the proposed offset area. This reflects more significant improvements in smaller areas of degraded habitat and more minor improvements likely to be seen in moderate to high quality habitat. It also reflects the active, property-level management of threats across the proposed offset area. As shown in **Section 7.3.3.2**, improvements in habitat quality are available across all three HQ components including: Site condition: • Abundance of fine and coarse woody debris, large logs and grass. Site context: • Increased abundance of surface rocks. • Threat management including legal procurement of current and future habitat and prevention of habitat clearing, suitable fire management consistent with species' requirements. Species stocking rate: • Presence detected will increase if the species is detected throughout the offset area. • Approximate density will increase with the improvement of species-specific habitat quality attributes such as coarse and fine woody debris and leaf litter mats.

Parameter	Input	Justification
Confidence in result (%) – HQ	90%	38 habitat quality assessments have been completed across proposed offset sites, F1, F2 and F3. These sites have informed required management actions to lift site condition, context and stocking rate. Further effort to map and characterise population density may also increase the stocking rate scoring.
Risk of loss (%) without offset	2.04 %	The offset areas support large areas of vegetation not currently regulated by the Queensland VM Act. These areas, particularly regrowth, are often subjected to regular, periodic or infrequent clearing. In the case of the proposed offset areas (F1, F2, F3 in particular), mapped collared delma habitat comprising approximately 3,500 ha is currently unregulated (42% of total collared delma habitat). Observations made by Umwelt (since 2020–2023) have recorded this land management process, resulting in the removal of suitable MNES habitat (including emergent habitat types). The removal of habitat recorded during a 2 year period (782.9 ha) equates to a 2.04 % risk of loss without offset. It is noted that average background clearing rate for Rockhampton (0.69%) and Banana Shire (0.08%) (Maseyk et al. 2017) has been considered in conjunction with the habitat loss observed. This reflects an informed region and local area specific measure of risk of loss, which is considered to be the best available information to inform the offset area calculations.
Risk of loss (%) with offset	0%	With the offset, the risk of loss is reduced to nil, by protecting the offset site through a legal mechanism. Risk of loss is not intended to reflect extreme and random loss events and, as such this is not reflected here. However it is noted that management measures will further reduce threats to the offset site.
Confidence in result (%) – ROL	90%	The confidence in a result reflects the conservative approach that has been taken regarding RoL metrics, which incorporate background clearing rates as per Maseyk et al. (2017), and a measured local RoL reduction in vegetation / habitat across a 2 year period.

7.3.7.6 Summary

The proposed offset areas support habitat for the collared delma, commensurate with the impact area habitat. These areas also provide opportunities for conservation gains as per the Offset Policy. This has been determined through extensive field surveys, using an approach consistent with that used in the impact area.

Using the anticipated OAG inputs as described above, the offset area requirement for 100% acquittal for the collared delma is anticipated to be 891.8 ha. Using field verified knowledge of the offset areas, the proposed properties are able to deliver the required offset area and achieve a suitable conservation gain for the species, as well as halting further decline and degradation.

The identification of existing threats to the species and indicative management actions will support the development of an OAMP. The OAMP will be developed after additional survey effort and further examination of offset properties. In a finalised OAMP, it is anticipated a single property or a blend of suitable habitat from several properties will enable an overall environmental improvement and counterbalance the impact to collared delma.

The proposed offset areas are able to provide a direct, land-based, like-for-like offset for the species and are capable of fully acquitting the Project Significant Residual Impact to collared delma habitat. As such, offsets on the identified properties are suitable, appropriate, and feasible, and able to be delivered in accordance with the Offset Policy.

8.0 Supplementary and Other Compensatory Measures

8.1.1 Supplementary Measures

As indicated in Section 10.0 of Attachment B4 (Assessment of Matters of National Environmental Significance), where areas of suitable habitat for MNES species become enclosed by Project infrastructure, populations of species with low dispersal ability within the enclosed area may become vulnerable to loss of genetic diversity, resulting in population decline (Coleman et al. 2018). MNES species most at risk of decline from fragmentation from enclosed areas are glider species including greater glider (southern and central) and yellow-bellied glider (south-eastern). Remaining MNES species known or with a moderate likelihood of occurrence have dispersal capabilities such that an access road or electrical reticulation line is unlikely to prevent movement between suitable habitat patches. This is with the exception of the collared delma which is thought to be sedentary and occupy a very small home range (<20 m^2).

The Project proposes mitigation measures to reduce the impact to threatened glider species due to fragmentation by Project infrastructure including the use of pinch points and the installation of glide poles to provide habitat connectivity to surrounding areas. Pinch points will reduce the width of linear infrastructure areas (roads and electrical reticulation lines) at key locations to the extent that individuals can disperse (i.e. based on usual volplane distances, the clearing will have a width no greater than 1.2 times the average canopy height at that location). At some locations, pinch points are proposed along enclosed sections of the Disturbance Footprint, thereby allowing threatened gliders to move in and out of the enclosed area, into neighbouring habitat.

The use of glide poles has been documented in yellow-bellied glider (south-eastern) on the Pacific Highway at Halfway Creek, north-east New South Wales (Taylor & Rohweder 2020) and as such is known to be an effective mitigation measure and hence supplementary offsets are not required. Greater glider (southern and central) has been identified using glide poles, however, it is not yet known if the species actually glides between them or between the woodland and the glide poles, therefore the effectiveness of glide poles as a mitigation measure for this species of glider is not yet known (Dalton 2017). The efficacy of glide poles established within the Disturbance Footprint will be investigated following clearing for the Project and installation of the poles. A glide pole monitoring survey will also be undertaken to determine the level of use of glide poles by greater glider (southern and central).

The success of mitigation measures aimed to support the movement of greater glider (southern and central) will determine if enclosed areas with glide poles are remain suitable for the long-term persistence of any local population. Consistent with the fourth principle of the Offset Policy, if these measures are unsuccessful in providing movement opportunities the habitat for the species occurring within enclosed areas would require offsetting via supplementary offsets.

The extent of habitat for each of these species occurring within enclosed areas is provided in **Table 8.1** below.

Table 8.1 Enclosed Areas Potentially Requiring Supplementary Offsets

Habitat Category	Enclosed Area (ha)
Likely or current denning habitat	4.1 ha
Potential or future denning habitat	2.3 ha
Foraging or dispersal habitat	34.4 ha
Total	**40.8 ha**

Based on the above, and considering the OAG inputs proposed for the greater glider (southern and central) (**Section 7.3.4.5**), the total land based offset required to compensate for enclosed habitat is 313.3 ha. This management strategy has identified 17,260.9 ha across potential offset properties, of which 2,527.2 ha would be used to satisfy the impacts from the wind farm. On this basis, it is anticipated that supplementary offsets could be co-located with the proposed offset.

8.1.2 Compensatory Measures

As per the second principle of the Offset Policy, the proposed offset detailed in this management strategy is built around direct offsets. However, it is noted that, for some MNES, the final offset may include other compensatory measures, delivering up to 10% of the overall offset requirement for the project.

Key knowledge gaps around species ecology, habitat and population dynamics, as well as the effectiveness of management interventions remain across the suite of threatened species being offset. The review of the EPBC Act (Samuel 2020) identified the clear need for additional research and data to support effective conservation of threatened species and communities. It states:

> *"There is insufficient capability to understand the likely impacts of the interventions made, particularly in a changing climate. Unacceptable information gaps exist, and many matters protected under the EPBC Act are not monitored at all… The lack of distribution, condition and trend data for terrestrial biodiversity is a key information gap and a barrier to successful environmental management."*

The inclusion of other compensatory measures in the offset package aims to deliver an offset that is not only effective, but provides valuable knowledge to the scientific community, proponents, and decision makers. Neoen are working with Central Queensland University to develop research proposals that can deliver the other compensatory measures in line with Appendix A of the Offset policy.

Research proposal(s) will be designed to deliver other compensatory measures and be developed in line with the Offsets Policy. Proposals will be submitted to DCCEEW for approval and will:

- Deliver up to 10% of the offset requirement.
- Outline how the proposal will generate knowledge that will aid in improving the viability of the protected matter(s).
- Identify knowledge gaps to be addressed by the proposal.
- Be clear on the scientific methods to be implemented.

- Include a project timeline with key dates.
- Include details on the research institution and project team.
- Demonstrate best practice research approaches.
- Include clear reporting requirements.

9.0 Offset Area Management

9.1 Development of Offset Area Management Plan

Following the approval of the project and further investigative field survey, an OAMP will be prepared. The purpose of the OAMP is to ensure the improvement or maintenance of significantly impacted MNES, via the establishment of clear guidance regarding the ongoing management and monitoring requirements required to achieve a conservation outcome. The OAMP will include the following components:

- Offset requirements, as conditioned for the project.
- Assessment methodology.
- Description/characterisation of the offset area, including land parcel details, habitat descriptions, offset values, offset suitability and presence of threats.
- Offset objectives, performance criteria and corrective actions.
- Finalise the legal mechanism to be used for the offset (further detail in **Section 7.2**).
- Offset area management actions, program, and monitoring schedule.
- Description of roles and responsibilities, along with reporting and review requirements.

9.1.1 Offset Area Aims and Management Actions

The final offset area will comprise a combination of vegetation communities and habitat units, potentially situated across several properties all of which are owned and managed by Neoen. The offset will aim to achieve the outcomes identified for each MNES.

While some of the proposed management actions relevant to habitat improvement will focus on specific areas within the proposed offset site, a number of management activities will be undertaken across the entire proposed offset site including feral animal control, fire management and land use management. A description of each of these measures will be provided in the OAMP.

Specific management actions, which consider the key habitat requirements, threats and offset outcomes for the five MNES will be established, will aim to improve the quality of their habitat within the proposed offset area. While the offset area will deliver species-specific outcomes, the area will be managed holistically, and most management actions will benefit multiple species.

9.1.2 Completion Criteria and Corrective Actions

Completion criteria will be derived from the habitat quality scores, to demonstrate the improvement in the quality of habitat in the offset area over a 20-year period. Interim milestones that set targets at 5-yearly intervals for progress towards achieving these offset completion criteria will also be developed.

Monitoring results will be used to determine if the interim milestones are being achieved. These interim milestones will provide an indication of the success of the management measures being implemented and serve as trigger values where failure to achieve these will result in the implementation of corrective actions.

9.1.3 Monitoring

Monitoring will be undertaken to evaluate the effectiveness of management actions and assess whether interim milestones are being met. Proposed monitoring, including the frequency and method of monitoring for each aspect, will be provided in the final OAMP.

9.1.4 Adaptive Management

An adaptive implementation program will be used to ensure uncertainty is reduced over time, and that completion criteria are attained and maintained over the period of approval. As more information becomes available following ongoing performance monitoring, the management and monitoring regime will be reviewed and revised to maximise the likelihood of attaining and maintaining the outcomes to be achieved by implementing the OAMP. Any updates to the OAMP which do not result in a material change to the environmental outcomes, performance and completion criteria will be made by Neoen without the requirement of informing the DCCEEW. If material amendments likely to alter the environmental outcomes, or performance and completion criteria are proposed to the OAMP, the amendments and justification for the contingency measures will be provided to the DCCEEW in writing.

Adaptive management will be used to incorporate changes in any of the following areas:

- Assimilation of new data or information – such as, updates to conservation advice or new threat abatement plans relevant to *Cycas megacarpa*, greater glider (southern and central), yellow-bellied glider (south-eastern), koala and northern quoll.
- Project coordination and scheduling – to manage unforeseen disruptions to schedule such as inclement weather on contractor works for management actions and environmental consultant monitoring events.
- Annual review of risks – to refresh the mitigation measures should new threats be identified or stochastic events such as unplanned fires or floods occur.
- Annual review of management measure effectiveness – to increase the frequency or change the method of management actions where monitoring performance criteria are not met.
- Contingency for unplanned incidents – such as stochastic events including unplanned fires or floods.

9.2 Reporting Requirements

9.2.1 Auditing and Review

The OAMP will be reviewed as part of the compliance reporting process following monitoring events scheduled at Years 1, 3 and 5.

Any relevant changes to the timeframes to achieve the performance criteria will be formally submitted to DCCEEW for approval.

Independent audits will be undertaken upon request by DCCEEW in accordance with the Conditions of Approval.

9.2.2 Monitoring Reporting

A monitoring report will be prepared after each monitoring event. Reporting will summarise methods and field data results, providing comparison against baseline and previous years and evaluating progress towards the performance or completion criteria.

The results of monitoring will be summarised or included in the annual compliance report, as relevant to that year.

9.2.3 Compliance Reporting

9.2.3.1 Annual Compliance Report

An Annual Compliance Report will be prepared, as relevant to that year, in accordance with the relevant EPBC approval condition and the DCCEEW's Annual Compliance Report Guidelines (2014). The compliance report will include:

- Details of compliance, incidents and non-compliance.
- Management actions undertaken within the offset areas and as part of control programs (with associated documentation attached).
- Remediation measures to be implemented where monitoring of the performance criteria indicates failure to achieve required outcomes.
- Progress towards and achievement of the ecological outcomes and completion criteria.

The results of monitoring surveys will be included in the annual compliance reports, as relevant to that year. Baseline data will be compared with monitoring data to demonstrate changes in offset area habitat quality scores and for identifying progress of management actions against the performance indicators and completion criteria. Remedial action or adaptive management will be provided based on monitoring results.

Results of the weed control program and planting/regeneration program will be included in the annual compliance report, as relevant, including inspections, control and maintenance activities undertaken on-site and follow-up treatments/monitoring conducted.

9.2.3.2 Reporting Non-Compliance

Notification in writing to DCCEEW must be made for any incident, non-compliance with the conditions, or non-compliance with the management action commitments made in this OAMP, in accordance with relevant conditions of the EPBC approval.

Notification must be made as soon as possible and no later than thirty business days after becoming aware of the incident or non-compliance.

10.0 Risk Assessment

A risk assessment was undertaken using the risk assessment process provided by the DCCEEW to assess the risks associated with failing to achieve the objectives outlined within this offset strategy regarding the mitigation of impacts to MNES. For each identified risk, the potential consequence of the risk (**Appendix C Table C.2**) was assessed against the likelihood of that risk occurring (**Appendix C – Table C.1**) to determine an overall risk rating using the matrix in **Appendix C – Table C.3**. The consequence and likelihood of each risk occurring was reassessed following the implementation of the management and mitigation measures (i.e. control measures) to provide a residual risk rating **Appendix C – Table C.5**. Added to **Appendix C – Table C.5** is a high level interpretation of the level of uncertainty in mitigating risks within the offset timeframes with levels of uncertainty described within **Appendix C – Table C.4**.

11.0 Conclusion

This Offset Management Strategy presents the Project's approach to offset delivery and provides a framework for further offset actions, delivered post Project approval, as part of the development of an OAMP.

The Project has taken extensive actions to avoid, minimise and mitigate, with ongoing avoidance actions proposed for *Cycas megacarpa* as part of detailed design. The Offset Management Strategy details the MNES values that will or are likely to trigger a significant residual impact under the EPBC Act, and therefore require further compensation, via the provision of an offset. The Project will ensure offset requirements are delivered in accordance with the Offset Policy, and fulfil the offset principles which underpin it. To this end, the Offset Management Strategy presents an approach built on the provision of direct, proponent driven offsets, situated within the immediate region of the impact location. It is noted that other compensatory measures (which can comprise up to 10 % of the offset requirement) have, and continue to be, investigated in accordance with the EPBC Act Offset Policy. In addition, a risk assessment was undertaken analysing potential risks to protected matters as well as to the delivery of the offset.

Based on extensive field data within the Project Disturbance Corridor and proposed offset areas, the proposed offsets are considered to be appropriate and feasible for the impacted protected matters. This includes habitat for MNES being commensurate with impacted values, for which the implementation of management actions would deliver a conservation gain. Further, the proposed offset areas are situated within the region where the Project is located, intersecting mapped biodiversity corridors.

Identified habitat quality improvement opportunities and associated management actions were tailored for each specific MNES, in accordance with corresponding conservation advice documents or recovery plans. Offset suitability was confirmed via the OAG, with calculations adopting a conservative approach to offset delivery, ensuring that offsets will be able to be delivered in accordance with the Offsets Policy.

The Project is taking steps to further refine the impact footprint (detailed design) and will continue to develop the offset delivery program. Key steps to be implemented by the Project include:

- Finalise detailed design, implementing avoidance principles.
- Prepare a supporting management plan (OAMP) which details the known / potential MNES values, habitat quality scores and required actions to be taken to achieve a conservation gain in accordance with the *EPBC Act Environmental Offsets Policy* (DSEWPaC 2012).
- Legally secure the offset area and begin monitoring / implementation of management actions.

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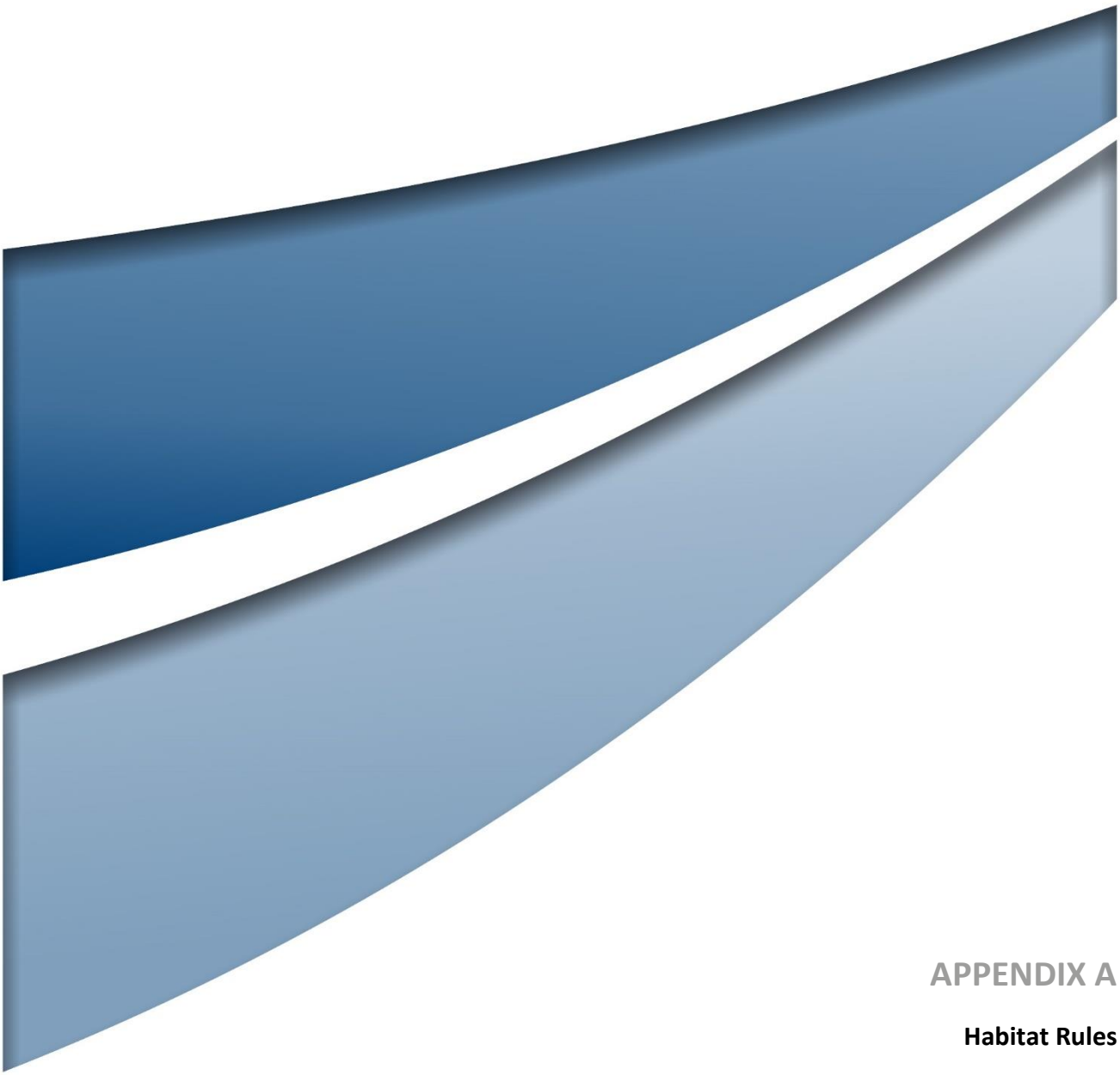


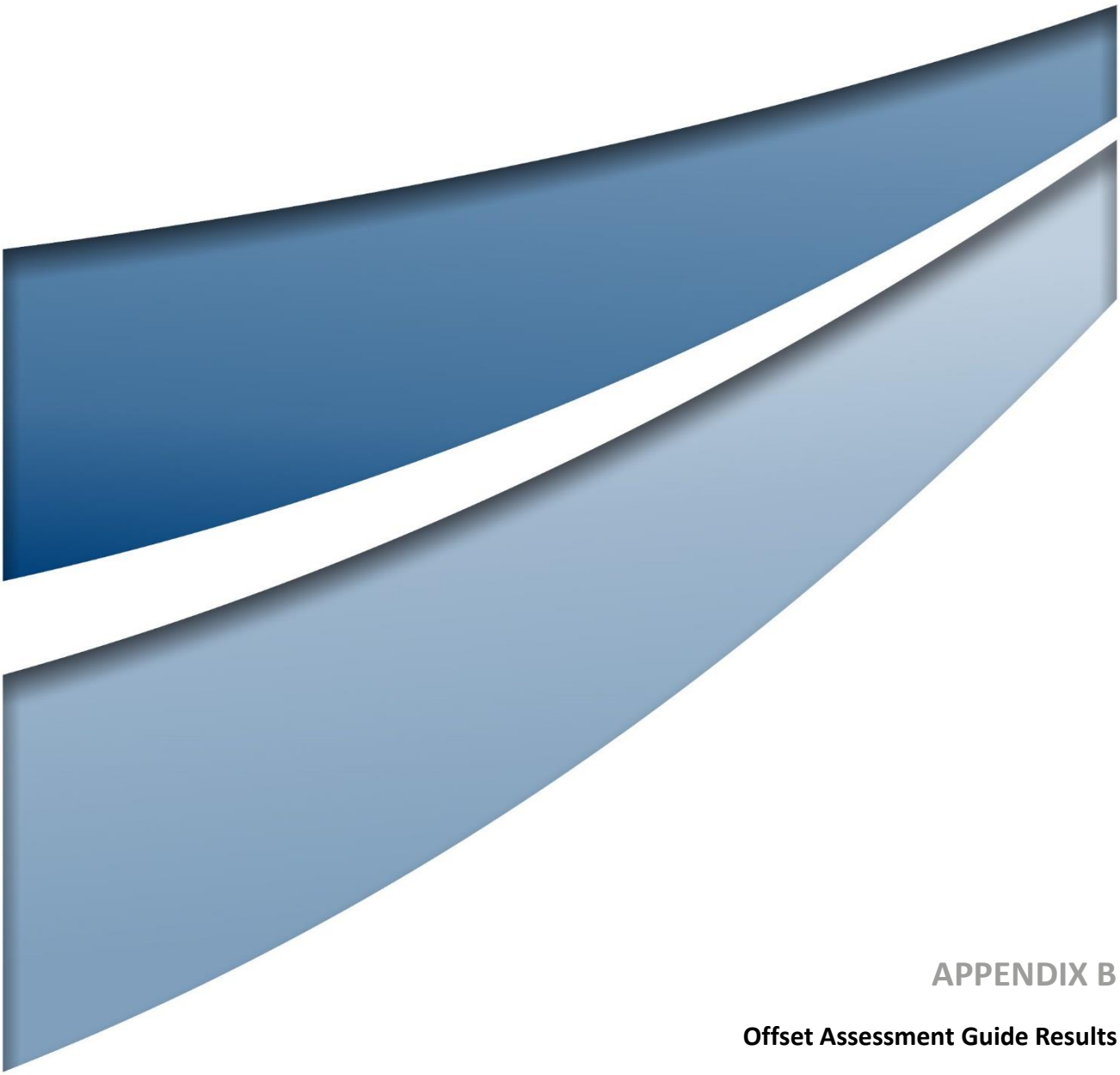
APPENDIX A

Habitat Rules

Species	Habitat	Habitat criteria	Mapping justification
Northern quoll (*Dasyurus hallucatus*)	Denning and Refuge	Rocky habitats (such as major drainage lines or treed creek lines) and structurally diverse woodlands with moderate to high density of denning opportunities (i.e. large diameter trees, termite mounds, large hollow logs).	Vegetation, watercourse, and 10-metre contour mapping was examined in conjunction with survey data (including floristics and habitat assessments) and high-quality Queensland Globe satellite imagery to manually identify hilly and rocky habitats including gullies, creeklines and structurally diverse woodlands.
Greater Glider (Central and Southern) (*Petauroides volans*)	Likely or Current Denning Habitat	Eucalypt forests and woodlands in Queensland REs considered habitat or potential habitat as per the Species Specific Guidance – Greater Glider habitats in Queensland (DES, 2022) containing appropriate tree species with a diameter at breast height greater than the RE threshold for large trees.	All areas of the following REs which contained trees that met the DBH threshold for large trees in the BioCondition benchmark: 11.3.25, 11.3.4, 11.3.4a, 11.11.3, 11.11.3c, 11.11.4, 11.11.4a, 11.11.4b, 11.11.4c, 11.11.15, 11.12.1, 11.12.6, 11.12.6a.
	Potential or Future Denning Habitat	Eucalypt forest and woodlands in Queensland REs considered habitat or potential habitat as per the Species Specific Guidance – Greater Glider habitats in Queensland (DES, 2022) containing appropriate tree species with a diameter at breast height greater than 30 cm, but less than the RE threshold for large trees.	All areas of the following REs which contained trees that had a DBH of 30 cm or greater but less than the DBH threshold for large trees in the BioCondition benchmark: 11.3.25, 11.3.4, 11.3.4a, 11.11.3, 11.11.3c, 11.11.4, 11.11.4a, 11.11.4b, 11.11.4c, 11.11.15, 11.12.1, 11.12.6, 11.12.6a.
	Foraging and Dispersal Habitat	Eucalypt forest and woodlands where locally important tree species for foraging are dominant/co-dominant AND in Queensland REs considered habitat or potential habitat as per the Species Specific Guidance – Greater Glider habitats in Queensland (DES, 2022).	All areas of the following REs where trees present did not have a DBH greater than 30 cm and/or did not meet the DBH threshold for large trees in the BioCondition benchmark: 11.3.25, 11.3.4, 11.3.4a, 11.11.3, 11.11.3c, 11.11.4, 11.11.4a, 11.11.4b, 11.11.4c, 11.11.15, 11.12.1, 11.12.6, 11.12.6a.

Species	Habitat	Habitat criteria	Mapping justification
Yellow-bellied Glider (*Petaurus australis*)	Breeding and Denning	Floristically diverse, mature eucalypt woodland and forest comprising intact and connected patches that contain live and large hollow-bearing trees. Habitat areas collectively (breeding and denning with foraging and dispersal) must form relatively large (>50 ha) tracts which may extend beyond the Study Area.	Select areas of seven REs (RE 11.3.4, 11.3.25b, 11.12.6, 11.11.3, 11.11.3c, 11.11.4a & 11.11.4b) were considered suitable for breeding and denning based on the presence of suitable hollow-bearing trees. Only vegetation in remnant condition contains suitable hollow-bearing trees as per the field validated data.
	Foraging and Dispersal	Mature eucalypt woodlands and forests that are floristically diverse or contain known sap trees in large (> 50 ha) or connected intact patches but lack live and large hollow-bearing trees. Habitat areas collectively (breeding and denning with foraging and dispersal) must form relatively large (>50 ha) tracts which may extend beyond the Study Area.	Excluding areas found to provide breeding and denning habitat, as well as highly exposed and narrow roadside vegetation with limited connectivity in the broader area, remaining areas of floristically diverse, remnant eucalypt woodland were considered to comprise foraging and dispersal habitat (i.e. REs 11.3.4, 11.3.25b, 11.3.25, 11.12.6, 11.11.3, 11.11.4, 11.11.4a, 11.11.4b, 11.11.4c). Two eucalypt woodland communities were deemed unsuitable (RE 11.11.15 and 11.12.1) due to their lack of known sap trees and canopy species diversity.
Koala (*Phascolarctos cinereus*)	Breeding, Foraging and Dispersal	Any forest or woodland (remnant, regrowth and modified vegetation communities) containing species that are koala food trees (trees of the genus *Eucalyptus*, *Corymbia* and *Angophora*) or any shrubland or grassland with emergent koala food trees or paddock trees.	All vegetation communities except SEVT in remnant or regrowth condition included.
	Climate Refugia	Forests or woodlands on drainage lines or riparian zones likely to provide a cooler refuge during periods of bushfire and heatwaves, including but not limited to regional ecosystems on land zone 3.	All eucalypt woodlands on land zone 3 are considered potential climate refugia.
Collared delma (*Delma torquata*)	Breeding and Foraging	Open eucalypt forest to woodland with exposed rocky areas. Must be associated with suitable microhabitat (rocks, logs, coarse woody debris and leaf litter) where ground cover is predominantly native grasses.	Remnant and mature regrowth open eucalypt forest to woodland on hilltops, slopes and alluvial soils where loose surface rocks are present in combination with course woody debris, fine and course litter to support breeding and foraging.

Species	Habitat	Habitat criteria	Mapping justification
Cycas megacarpa	Mapped habitat	Known habitat (confirmed)	An 80 m buffer on confirmed *Cycas megacarpa* records, to reflect the latest population research which indicates most individuals disperse within 80 m of mature female plants (Etherington et al. 2018; James 2016 PhD thesis). Mapping has not been limited to certain REs noting the species was also recorded within non-remnant vegetation within the Study Area.
		Known habitat (suspected)	Includes areas of the Development Corridor for which known habitat (confirmed) does not overlap, however based on adjacent records and connective habitat, *Cycas megacarpa* presence is presumed or reasonably suspected.



APPENDIX B

Offset Assessment Guide Results

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Collared delma
EPBC Act status	Vulnerable
Annual probability of extinction Based on IUCN category definitions	**0.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes		**Area**	272.8	Hectares	
			Quality	**6**	Scale 0-10	
			Total quantum of impact	163.68	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	163.68	Adjusted hectares	OAMP - all areas	**Time over which loss is averted (max. 20 years)**	20	**Start area (hectares)**	891.8	**Risk of loss (%) without offset**	2%	**Risk of loss (%) with offset**	0%								
									Future area without offset (adjusted hectares)	873.6	**Future area with offset (adjusted hectares)**	891.8	18.19	90%	16.37	15.73	163.68	100.00%	Yes	
					Time until ecological benefit	20	**Start quality (scale of 0-10)**	**7**	**Future quality without offset (scale of 0-10)**	**6**	**Future quality with offset (scale of 0-10)**	**8**	2.00	90%	1.80	1.73				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	163.68	163.68	100.00%	**Yes**	$0.00	#DIV/0!	#DIV/0!
Area of community	0				$0.00		$0.00
					$0.00	**#DIV/0!**	**#DIV/0!**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

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Matter of National Environmental Significance	
Name	Cycas megacarpa
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	**1.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes		**Area**	641.5	Hectares	
			Quality	**8**	Scale 0-10	
			Total quantum of impact	513.20	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	513.20	Adjusted hectares	OAMP - all areas	**Time over which loss is averted (max. 20 years)**	20	**Start area (hectares)**	3410.5	**Risk of loss (%) without offset**	2%	**Risk of loss (%) with offset**	0%	69.57	90%	62.62	49.33	513.19	100.00%	Yes	
									Future area without offset (adjusted hectares)	3340.9	**Future area with offset (adjusted hectares)**	3410.5								
					Time until ecological benefit	20	**Start quality (scale of 0-10)**	**7**	**Future quality without offset (scale of 0-10)**	**6**	**Future quality with offset (scale of 0-10)**	**8**	2.00	90%	1.80	1.42				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	513.2	513.19	100.00%	**Yes**	$0.00	#DIV/0!	#DIV/0!
Area of community	0				$0.00		$0.00
					$0.00	**#DIV/0!**	**#DIV/0!**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

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Matter of National Environmental Significance	
Name	Greater glider
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	**1.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes		**Area**	627.9	Hectares	
			Quality	**6**	Scale 0-10	
			Total quantum of impact	376.74	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	376.74	Adjusted hectares	OAMP - all areas	**Time over which loss is averted (max. 20 years)**	20	**Start area (hectares)**	2528	**Risk of loss (%) without offset**	2%	**Risk of loss (%) with offset**	0%								
									Future area without offset (adjusted hectares)	2476.4	**Future area with offset (adjusted hectares)**	2528.0	51.57	90%	46.41	36.56	376.74	100.00%	Yes	
					Time until ecological benefit	20	**Start quality (scale of 0-10)**	**6**	**Future quality without offset (scale of 0-10)**	**5**	**Future quality with offset (scale of 0-10)**	**7**	2.00	90%	1.80	1.42				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	376.74	376.74	100.00%	**Yes**	$0.00	N/A	$0.00
Area of community	0				$0.00		$0.00
					$0.00	**$0.00**	**$0.00**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Koala
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	**1.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes		**Area**	646.9	Hectares	
			Quality	**7**	Scale 0-10	
			Total quantum of impact	452.83	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	452.83	Adjusted hectares	OAMP - all areas	**Time over which loss is averted (max. 20 years)**	20	**Start area (hectares)**	3009.5	**Risk of loss (%) without offset**	2%	**Risk of loss (%) with offset**	0%	61.39	90%	55.25	43.53	452.85	100.00%	Yes	
									Future area without offset (adjusted hectares)	2948.1	**Future area with offset (adjusted hectares)**	3009.5								
					Time until ecological benefit	20	**Start quality (scale of 0-10)**	**7**	**Future quality without offset (scale of 0-10)**	**6**	**Future quality with offset (scale of 0-10)**	**8**	2.00	90%	1.80	1.42				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	452.83	452.85	100.00%	**Yes**	$0.00	N/A	$0.00
Area of community	0				$0.00		$0.00
					$0.00	**$0.00**	**$0.00**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Northern quoll
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	**1.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes		**Area**	22.1	Hectares	
			Quality	**5**	Scale 0-10	
			Total quantum of impact	11.05	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	11.05	Adjusted hectares	OAMP - all areas	**Time over which loss is averted (max. 20 years)**	20	**Start area (hectares)**	76.4	**Risk of loss (%) without offset**	1%	**Risk of loss (%) with offset**	0%	0.53	90%	0.47	0.37	11.06	100.07%	Yes	
									Future area without offset (adjusted hectares)	75.9	**Future area with offset (adjusted hectares)**	76.4								
					Time until ecological benefit	20	**Start quality (scale of 0-10)**	**7**	**Future quality without offset (scale of 0-10)**	**6**	**Future quality with offset (scale of 0-10)**	**8**	2.00	90%	1.80	1.42				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	11.05	11.06	100.07%	**Yes**	$0.00	N/A	$0.00
Area of community	0				$0.00		$0.00
					$0.00	**$0.00**	**$0.00**

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Yellow-bellied glider
EPBC Act status	Vulnerable
Annual probability of extinction Based on IUCN category definitions	**0.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

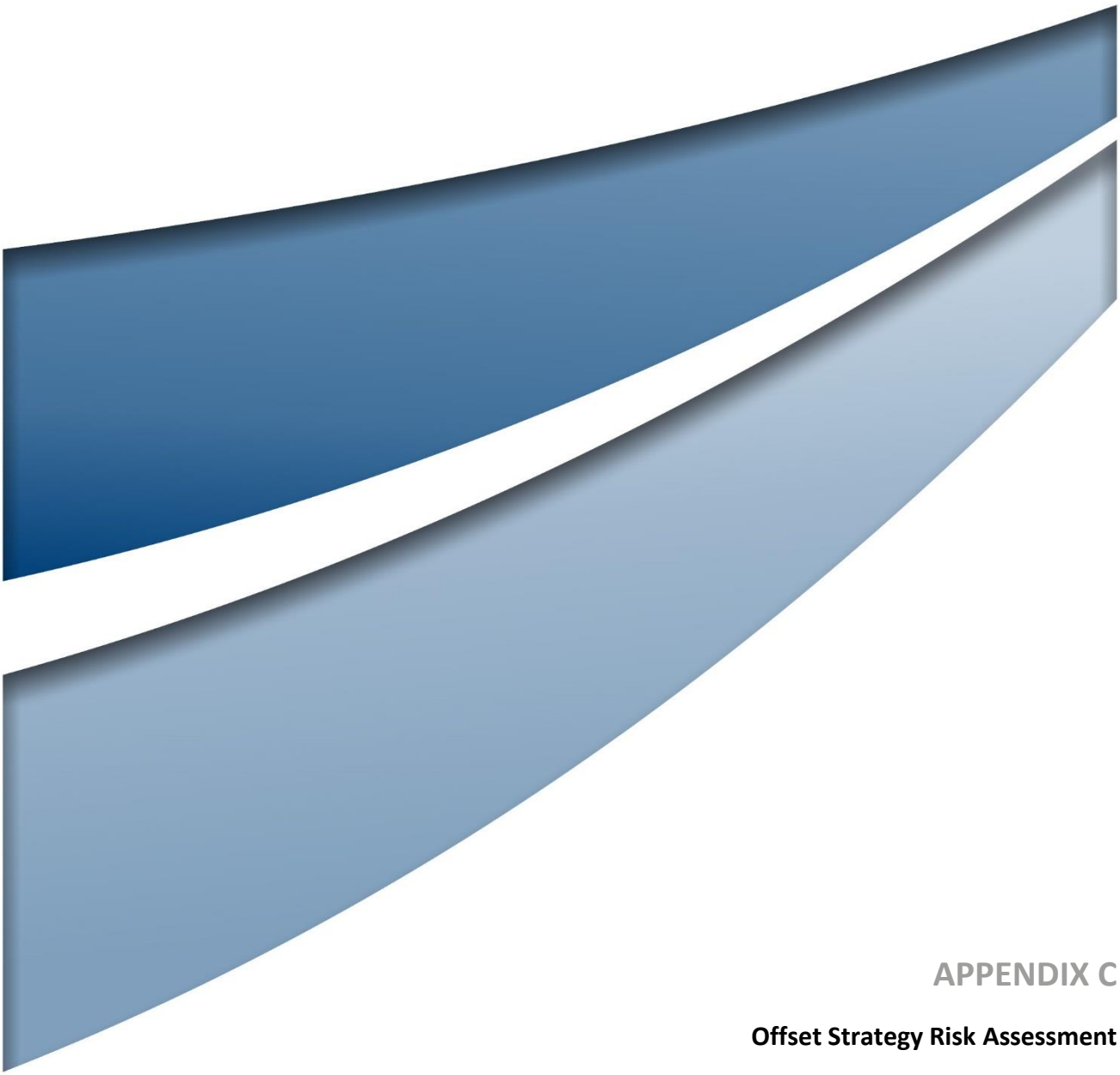
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes		**Area**	322	Hectares	
			Quality	**6**	Scale 0-10	
			Total quantum of impact	193.20	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	193.20	Adjusted hectares	OAMP - all areas	**Time over which loss is averted (max. 20 years)**	20	**Start area (hectares)**	1062.9	**Risk of loss (%) without offset**	2%	**Risk of loss (%) with offset**	0%	21.68	90%	19.51	18.75	193.20	100.00%	Yes	
									Future area without offset (adjusted hectares)	1041.2	**Future area with offset (adjusted hectares)**	1062.9								
					Time until ecological benefit	20	**Start quality (scale of 0-10)**	**6**	**Future quality without offset (scale of 0-10)**	**5**	**Future quality with offset (scale of 0-10)**	**7**	2.00	90%	1.80	1.73				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	193.2	193.20	100.00%	**Yes**	$0.00	N/A	$0.00
Area of community	0				$0.00		$0.00
					$0.00	**$0.00**	**$0.00**



APPENDIX C

Offset Strategy Risk Assessment

Table C.1 Likelihood Classification

Qualitative measure of likelihood (how likely is it that this event/circumstances will occur after management actions have been put in place/are being implemented)	
L5 – Highly Likely	The event is expected to occur in most circumstances
L4 – Likely	The event will probably occur in many circumstances
L3 – Possible	Identified factors indicate the event may occur at some time
L2 – Unlikely	The event could occur at some time but is not expected
L1 – Rare	The event may occur only in exceptional circumstances

Table C.2 Consequence Classification

Qualitative measure of consequences (what will be the consequence/result if the issue does occur)	
C5 – Critical	The plan's objectives are unable to be achieved, with no evidenced mitigation strategies. Permanent and/or very long-term damage to areas of significant value.
C4 – Major	Unlikely to achieve objectives. Significant barriers to attainment (technical, administrative, ecological, legislative). Significant and/or long-term damage to areas of high value.
C3 – High	High risk of failure. Medium-long term delays to achieving plan objectives, implementing uncertain, high cost/effort corrective actions. Medium-term damage to areas of value.
C2 – Moderate	Moderate risk of failure. Short term delays to achieving plan objectives, implementing well characterised, high cost/effort corrective actions. Minor and/or short-term damage to areas of low value.
C1 – Minor	Minor risk of failure. Short term delays to achieving plan objectives, implementing low cost, well characterised corrective actions. Insignificant or very short-term damage to areas of very low or negligible value.

Table C.3 Risk Rating Matrix

	Consequence					
Likelihood	Rating	L1	L2	L3	L4	L5
	C5	High	High	Extreme	Extreme	Extreme
	C4	Moderate	Moderate	High	High	Extreme
	C3	Moderate	Moderate	Moderate	High	High
	C2	Low	Moderate	Moderate	Moderate	High
	C1	Low	Low	Low	Moderate	Moderate

For the purposes of this risk assessment, the risk levels are defined as follows:

- Extreme: Unacceptable risk that must not proceed until suitable and comprehensive control measures have been adopted to reduce the level of risk.
- High: Moderate to critical consequences. Works should not proceed without considerations of additional actions to minimising the risk.
- Medium: Acceptable with formal review. Medium level risks require active monitoring due to the level of risk being acceptable.
- Low: Acceptable with active management not considered required.

Table C.4 Uncertainty in Mitigation of Risk

Level of Uncertainty	Description
High	High levels of uncertainty. Unable to fully interpret future changes which will likely impact the effectiveness of the offset.
Moderate	Moderate levels of uncertainty. Modelling or legislative requirements are likely to change within the duration of the offset. Knowledge and best practices frequently updated or improved.
Low	Low levels of uncertainty. Existing knowledge and best practice sporadically updated or improved. Legal or review mechanisms in place to ensure regular evaluation of risks.

Table C.5 Risk Assessment and Management

Event	Description	Initial Likelihood	Initial Consequence	Initial Risk level	Management	Residual Likelihood	Residual Consequence	Residual Risk level	Management Trigger	Uncertainty in mitigation
Destruction of habitat, Habitat modification, disturbance or loss, fragmentation of native vegetation cover	Unplanned or illegal clearing, presence of vehicles traversing off designated tracks, spray drift via application of chemicals from adjacent properties. Outcomes include loss of denning habitat, loss of hollows, fragmentation of vegetation loss of foraging or shelter opportunities.	L3	C4	High	No unapproved and/or intentional clearing of vegetation within the offset area, except for clearing that is required for fencing, access, firebreaks, or public safety.	L2	C4	Moderate	Any activities that are in contravention of the Voluntary Declaration. Detection of prohibited clearing outside of established access tracks, fire control lines and fence lines.	Low. Voluntary declaration / legal mechanisms developed as part of the offset area will reduce the uncertainty of risk. Legislation and legal mechanisms likely to limit impacts to vegetation from current or future landholders.
Direct mortality from vehicle strike	Offset areas potentially located in close proximity to Project. Increases in vehicles traversing the general project area during construction may provide additional risk of vehicle strike to several species.	L3	C2	Moderate	Redirect vehicle traffic away from boundaries of offset areas. Reduce vehicle speeds to improve reaction times, thereby reducing collision risk. Limit access to offset areas.	L2	C2	Moderate	Occurrences of species mortality associated with vehicle strike.	Low. Limiting access and redirecting traffic away from offset sites greatly reduces the risk associated with vehicle strike. In the longer term, outside of construction, vehicle movements limited to landholder activities and monitoring.
Habitat degradation through unsuitable grazing practices	Inappropriate stock grazing destroys shrubs and native grass cover and slows or reverses the regeneration of vegetative communities.	L3	C3	Moderate	Development and implementation of grazing management/strategies for the offset area refined under consultation with landholders i.e., rotational, or seasonal grazing programs. These grazing strategies are to be maintained throughout the entire extent of the offset period. Grazing strategies to be developed in conjunction with weed control and fire management strategies.	L2	C2	Moderate	Evidence of unauthorised or unmanaged grazing within the offset site identified during ongoing monitoring events. Decrease in the habitat condition of the offset matters identified as part of habitat condition assessments. Livestock present outside of strategic grazing events.	Low. Existing grazing practices are known, with new revolutionary grazing practice changing current grazing methods unlikely. Changes to land ownership may impact grazing methods; however, legal mechanisms developed as part of the offset area will counteract any issues with change of land ownership.
Increased fire risk or uncontrolled fires through inappropriate or altered fire regime	An uncontrolled bushfire may degrade a portion of or the entire offset site and increase the potential for other risks (erosion). Poorly timed fire management may also reduce environmental outcomes for the offset site.	L3	C4	High	Development and implementation of fire management/strategies for the offset area refined under consultation with landholders. These fire management strategies are to be maintained throughout the entire extent of the offset period. Controlled burns undertaken in consultation with landholder as well as fire management guidelines ensuring a range of burn strategies are incorporated, i.e., mosaic burns. Firebreaks are created around the offset boundary to minimise unplanned fire from adjacent landholders.	L2	C4	Moderate	Unplanned fire within the offset area. Planned fires become out of control or the required burning regime is not achieved. Additional weed species coverage increases potential fuel loads.	Moderate. Future climatic conditions have the prospect to be highly variable with the potential for long periods of drought or several years of above average rainfall promoting unusually high vegetation growth rates. However, following detailed fire management plan with a range of burn strategies will reduce the uncertainty in managing this risk.

Event	Description	Initial Likelihood	Initial Consequence	Initial Risk level	Management	Residual Likelihood	Residual Consequence	Residual Risk level	Management Trigger	Uncertainty in mitigation
					Firebreaks co-located with existing roads, fence lines and access tracks where possible.					
Disease	Increase or presence of disease within individuals of the population within the offset area. E.g., Toxoplasmosis in northern quoll or chlamydia or retrovirus in koala.	L2	C4	Moderate	Ongoing monitoring of species populations within the offset area. Implementation of pest species, fire and weed management plans to reduce potential stress to individuals within the offset area.	L1	C4	Moderate	Observation or increased presence of diseased individuals within the offset area.	Moderate. Several offset species are known to host a range of pathogens or parasites. Currently few impact populations; however, increased pressure/stress due to factors occurring across the wider population (habitat loss) may increase the susceptibility of species to disease over time.
Increase in introduced species providing greater competition or predation	Increased presence of feral animals, such as pigs and rabbits, causing vegetation degradation within the offset area. Presence of feral predators increasing mortality	L3	C3	Moderate	Pest animal management will be undertaken in consultation with the landowner and in accordance with general pest management processes. Pest management will include a range of best management practice actions undertaken in accordance with Queensland's Department of Agriculture and Fisheries (DAF) guidelines and the requirements of the *Biosecurity Act 2014*.	L2	C3	Moderate	Observed increase in sightings/signs and/or the relative abundance of pest animals. Observation of, or signs of, a feral animal not previously identified as occurring within the offset area.	Low. The opportunity for new species to establish over the duration of the offset is low-moderate. The likelihood that these species will negatively impact offset matter species is also low.
New weed infestations within the offset area	Infestation of previously unidentified invasive weeds within the offset area. Expansion of range and abundance of existing weed species within the offset site.	L3	C3	Moderate	Weed management and weed hygiene restrictions will be implemented across the offset site to reduce the extent of existing weeds and to control potential introduction of new weed species. All vehicles accessing the offset area are required to have undergone a weed inspection and vehicle hygiene check, confirming that they are weed free, before accessing the site. Chemical and mechanical control of all declared weeds in accordance with the control measures outlined in the Biosecurity Queensland Fact Sheets. Weed control to be developed in conjunction with fire and grazing management.	L2	C2	Moderate	An increase in weed species richness or abundance or cover within the offset site identified as part of weed monitoring and habitat condition assessments.	Low. Weed species reproduction and spread are well studied as are control methods. Following management actions is unlikely to result in new or expanding weed infestations.

Event	Description	Initial Likelihood	Initial Consequence	Initial Risk level	Management	Residual Likelihood	Residual Consequence	Residual Risk level	Management Trigger	Uncertainty in mitigation
Offset fails to achieve performance targets or completion criteria. Offset initially achieves performance targets, however, fails to meet completion criteria.	The offset site does not meet the requirements of the offset policy or outcomes that were the key rationale for the decision approval	L2	C5	High	A voluntary declaration or legal requirements will ensure landholder(s) remain committed to the effectual management of the offset to achieve completion criteria targets.	L1	C5	Moderate	Interim targets defined but not achieved. Completion criteria not achieved.	Moderate. Regular timely monitoring or review of targets and outcomes will provide a baseline to evaluate performance targets. Legal mechanisms developed as part of the offset area will also provide the stimulus to landholder(s) commitment to achieving the completion criteria.
Climate change	Changes to climate with the potential to impact the long-term viability of the offset. Includes: • Extreme temperatures and heatwaves • Extreme rainfall and flooding • Extreme storms • Solar radiation • Bushfire weather.	L4	C4	High	Co-ordinate strategy involving weed control, grazing and fire management. Update any management plans to consider the latest climate data or latest standards/protocols. Review of climate tools such as the Climate Analogous explorer to monitor the suitability of the offset to provide suitable conditions for target species.	L3	C3	Moderate	No specific trigger. Continual review (at least every five years) in line with other completion criteria targets.	Moderate. Research and knowledge continues and is ongoing. Models and predictions are continuously refined. Additional data and improved modelling are expected to reduce the uncertainty for the management of risks.
Drought	Drought events are likely to decrease ground cover and increase the probability of uncontrolled / unplanned fires. Poor ground layer coverage may promote increased weed growth when rainfall occurs.	L3	C3	Moderate	Limited mitigation measures given this is a natural event and subject to changing climatic cycles/conditions. Co-ordinate strategy involving weed control, grazing and fire management. Update any management plans to consider the latest climate data or latest standards/protocols.	L3	C3	Moderate	Drought declaration as per state listing.	Moderate. Future climatic conditions have the prospect to be highly variable with the potential for long periods of drought or several years of above average rainfall. Future climate/weather modelling is expected to continually improve, thereby reducing the uncertainty for management of the offset area.
Cyclone	Cyclones or tropical lows have the potential to impact vegetation canopies including hollows, as well as promoting increased weed growth.	L3	C3	Moderate	Limited mitigation measures given this is a natural event and subject to changing climatic cycles/conditions. Co-ordinate strategy involving weed control, grazing and fire management. Update any management plans to consider the latest climate data or latest standards/protocols.	L3	C3	Moderate	Any incident of cyclone or flood impacting the site	Moderate.